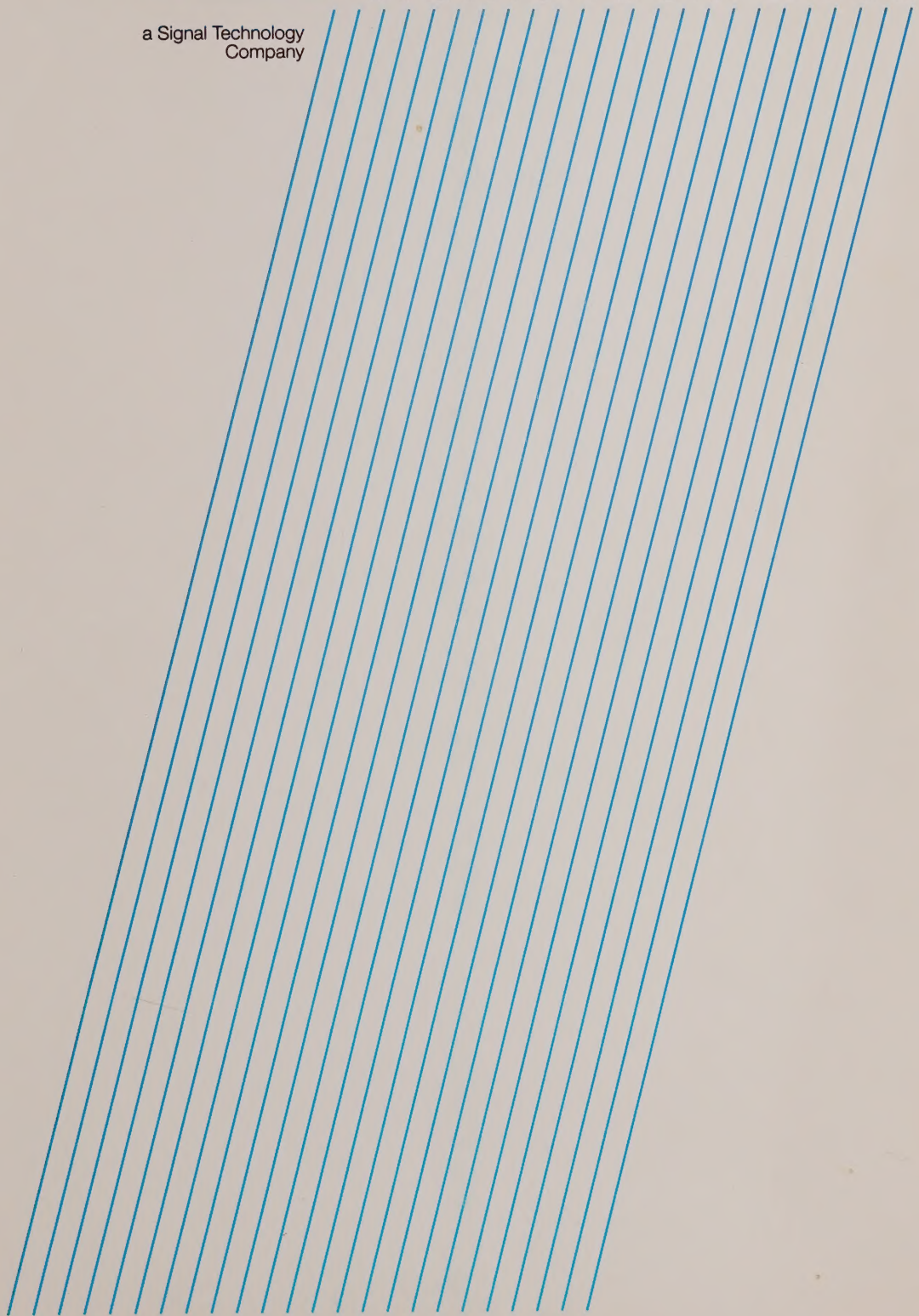
624XA

SYSTRON DONNER CORP.

a Signal Technology Company



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OPERATING AND SERVICE MANUAL

624XA SERIES
FREQUENCY COUNTERS

DOCUMENT PART NO. 120041-01

The 624XA Series Manual consists of:
6241A
6242A
6243A
6244A

SYSTRON DONNER CORP.
a Signal Technology Company

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Sylmar, California 91342

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CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains operating, functional description and maintenance instructions for the Systron-Donner Models 6241A, 6242A, 6243A and 6244A frequency counters. Instrument specifications, installation instructions, replacement parts lists and standard option descriptions are also included for the four counters.

The 624XA Communications Counters Series consists of four counters designed to provide frequency measurements from 20 Hz to 4.5 GHz.

The four counters differ primarily in frequency range. All models offer excellent sensitivity, overload protection, and accuracy. In addition, each counter can be equipped with a variety of options to satisfy the needs of individual users. Available options include low frequency tone measurements, built-in battery operation, and digital outputs.

The instruments are lightweight, easy to carry and easy to use. In addition to communications requirements, any of these compact counters can be used wherever high sensitivity, wide range frequency measurements are required.

The counters feature a highly readable eight digit LED display. Front panel controls are self explanatory to provide visual readout of the frequency measured in kHz (A input) or MHz (B and C inputs). An expanded frequency multiplier function available as a option, permits low frequency measurements in Hz. Automatically positioned decimal point and leading zeros suppression, beyond the units digit, provide unambiguous error free reading with resolutions to 0.1 Hz. When operating in the low frequency multiplier measurement mode readout is in Hz with resolutions of 0.1, 0.01 and 0.001.

Options include the aforementioned low frequency multiplier, five higher stability oscillators, and a rear panel BCD digital output of the eight digit display with decimal point and units indicator.

1.2 SPECIFICATIONS

Specifications for the Model 624XA Series counters are compiled in Table 1.1

TABLE 1.1 SPECIFICATIONS

FREQUENCY MEASUREMENT	
Frequency Range	20 Hz to 4.5 GHz.
A INPUT	20 Hz to 100 MHz (6241A, 6242A, 6243A and 6244A).
B INPUT	100 MHz to 1.25 GHz (6243A) 100 MHz to 512 MHz (6242A and 6244A).
C INPUT	500 MHz to 4.5 GHz (6244A).
A Input Direct (All four Models)	
Range	20 Hz to 100 MHz.
Resolution	0.1 Hz to 1 kHz selectable, in decade steps.
Display	Reads in kHz with automatically positioned decimal point. Leading zeros beyond the units decade are suppressed.
Accuracy	±1 count ±time base accuracy.
B Input ÷16 Prescaler (Model 6243A)	
Range	100 MHz to 1250 MHz.
Resolution	0.1 Hz to 1 kHz selectable in decade steps.
Display	Reads in MHz with automatically positioned decimal point.
Accuracy	±1 count ±time base accuracy.
B Input ÷4 Prescaler (Model 6242A)	
Range	100 MHz to 512 MHz.

TABLE 1.1 SPECIFICATIONS (CONT)

FREQUENCY MEASUREMENT (Cont)	
Resolution	0.1 Hz to 1 kHz selectable in decade steps.
Display	Reads in MHz with automatically positioned decimal point.
Accuracy	±1 count ±time base accuracy.
C Input ACTO (Model 6244A)	
Range	500 MHz to 4.5 GHz.
Resolution	0.1 Hz to 1 kHz selectable in decade steps.
Display	Reads in MHz with automatically positioned decimal point.
Accuracy	±1 count ±time base accuracy.
INPUT CHARACTERISTICS	
Input Impedance	
A Input	1 MΩ/25 picofarads.
B Input	50Ω nominal
C Input	50Ω nominal
Sensitivity	
A Input	10 mVrms
B Input	10 mVrms (-27 dBm)
C Input	-13 dBm
Overload Without Damage	
A Input	500V peak (dc plus ac component); 250 Vrms, 20 Hz to 10 kHz; 50 Vrms, 10 kHz to 2 MHz; 5 Vrms, 20 MHz to 100 MHz.
B Input	5 Vrms, fuse protected.
C Input	+20 dBm, PIN diode leveler protected.

TABLE 1.1 SPECIFICATIONS (CONT)

TIME BASE	
Aging Rate After warm up	±2 parts in 10^6/year.
Short Term Aging	5 parts in 10^9 rms for 1 second average.
Long Term Aging	±3 parts in 10^7 for 30 days.
Temperature Stability	5 parts in 10^6 from 0°C to 50°C.
Line Voltage	±part in 10^7 for 10% line voltage variation.
External Input	1 MHz at 1 Vrms into 500Ω switch selectable.
Time Base Output	Clock Out (rear panel) TTL 1 MHz output through 470Ω.
GENERAL	
Readout Display	0.4" LED eight digit in-line readout with decimal point. Automatic leading zero suppression. Off Scale indicator for overflow and a Gate indicator.
Display Storage	Switch selectable, rear panel, display storage. Holds readings between samples.
Lamp Test	Illuminates all segments of all digits.
Power Requirements	100-115 or 200-230 Vac ±10% 48-440 Hz, 17W.
Dimensions	3.47" H X 8.37" W X 13.36" D 8.81 cm X 21.26 cm X 33.93.
Weight	10 lbs (4.5 kg) net; 17 lbs 7.7 kg) shipping.

1.3 OPTIONS

The options listed in Table 1-2 are standard options available for this instrument.

TABLE 1-2 STANDARD OPTIONS

OPTION	DESCRIPTION	
06	Internal Battery Pack (all models except 6244A), ac or dc operation. May not be installed with Option 10 or Option 45.	
08	High stability time base oscillator. Improves oscillator stability to:	
	Aging rate after warm up.	±1 part in 10^6/ year.
	Frequency retrace for off periods to ≈24 hours.	±5 parts in 10^7 within 15 min.
	Short term aging rate.	±5 parts in 10^8/ day average for 3 days.
	Long term aging rate.	±3 parts in 10^7 for 30 days.
	Temperature stability.	TCXO 1 part in 10^6 over 0°C to 50°C.
	10% Line Voltage.	±5 parts in 10^8.
10	High stability time base oscillator. Improves oscillator stability to:	
	Aging rate after warm up.	±1 part in 10^8/ day.
	Frequency retrace for off periods to ≈24 hours.	±2 parts in 10^7 within 15 min.
	Short term aging rate.	±5 parts in 10^{10}/ rms for 10 sec. average.
	Long term aging rate.	±1.5 parts in 10^7 for 30 days.
	Temperature stability.	TCXO 1 part in 10^7 over 0°C to 50°C.
11	High Stability Oscillator	
	Aging rate after warm up.	<±3 parts in 10^9/ 24 hours.

TABLE 1-2 STANDARD OPTIONS (Cont'd)

OPTION	DESCRIPTION	
11 (Cont'd)		
	Maximum warm up for off periods to 1 week.	72 hours.
	Frequency Retrace for off periods to approximately 24 hours.	1 hour typical to reach ±6 parts in 10^8 maximum.
	Short term aging rate.	±1 part in 10^{10} rms for 1 second average.
	Temperature variation	<±2 parts in 10^{10}/ °C typical. Maximum: ±4 parts in 10^9 over a 20°C change within the range of -20°C to +55°C.
	10% line voltage change from spec.	±5 parts in 10^{10}.
	Long term aging rate.	±3 parts in 10^8 for 30 days.
12	High Stability Oscillator	
	Aging rate after warm up.	<±1 part in 10^9/ 24 hours.
	Maximum warm up for off periods to 1 week.	72 hours.
	Frequency retrace for off periods to approximately 24 hours.	1 hour typical to reach ±6 parts in 10^8 maximum.
	Short term aging	±1 part in 10^{10}/ rms for 1 second average.
	Temperature variation	<±2 parts in 10^{10}/ °C typical. Maximum: ±4 parts in 10^9 over a 20°C change within the range of -20°C to +55°C.

TABLE 1-2 STANDARD OPTIONS (Cont'd)

OPTION	DESCRIPTION	
12 (Cont'd)		
	10% line voltage change from spec.	±5 parts in 10^{10}
	Long term aging rate.	±3 parts in 10^{8} for 30 days.
13	High Stability Oscillator	
	Aging rate after warm up.	+5 parts in 10^{10}/ 24 hours.
	Maximum warm up for off periods to 1 week.	72 hours.
	Frequency retrace for off periods to approximately 24 hours.	1 hour typical to reach <±5 parts in 10^{9}.
	Short term aging rate.	±5 parts in 10^{11} rms for 1 second average.
	Temperature variation.	<±2 parts in 10^{10}/ °C typical. Maximum: ±4 parts in 10^{9} over a 20°C change within the range of -20°C to +55°C.

TABLE 1-2 STANDARD OPTIONS (Cont'd)

OPTION	DESCRIPTION	
13 (Cont'd)		
	10% line voltage change from spec.	±5 parts in 10^{10}.
	Long term aging rate.	±1.5 parts in 10^{8} for 30 days.
35	Digital BCD Output. Parallel 8-4-2-1 BCD digital outputs with decimal point and measurement units indication.	
45	Provides high speed direct readings measurements (in Hz) of low frequency signals with resolution to 0.001 Hz. See Multiplier specifications below:	
	A Input Multiplier	
Range	50 to 3000 Hz.	
Multiplier	X100	
Resolution	0.001 Hz to 0.1 Hz selectable in decade steps.	
Digit	Reads in Hz with automatically positioned decimal point. Leading zeros beyond the units decade are suppressed.	
Accuracy	±3 count ±time base accuracy.	

CHAPTER 2

INSTALLATION

2.1 INTRODUCTION

The S-D Model 624XA Series Frequency Counters are shipped in an operational condition and are ready for use as received. This chapter outlines the procedures for initial inspection and installation of the instrument. Instructions for reshipment are also included should the unit be returned for service or repair.

2.2 RECEIVING INSPECTION

Prior to accepting the counter from the shipper, inspect the condition of the shipping container for any indication of freight damage. Any sign of damage should be noted by both the shipper and receiver and should be reported to the insurance investigator.

Immediately following removal of the instrument from the shipping carton, inspect for possible physical damage incurred during shipment. Check surfaces for scratches or dents and note conditions of controls and connectors. Should any damage be noted, notify your nearest Systron-Donner representative - DO NOT USE THE COUNTER UNTIL INSTRUCTED TO DO SO BY THE REPRESENTATIVE.

2.3 RESHIPMENT

When the instrument is to be packaged for shipment use the original packing material if possible. Your Systron-Donner field office can provide materials similar to those used for the original factory packaging; or, repackage the instrument following these general instructions.

General Packing Instructions

Attach a tag to the unit indicating the Model number, serial number, name and address of the instrument owner, and a summary of the service or repairs required.

Wrap the instrument in heavy paper or plastic prior to placing it into the shipping container.

Select a strong carton or wooden box to house the instrument.

Use an adequate layer of shock absorbing material on all sides of the instrument and protect the front panel with additional layers of cardboard. Be certain that there is no movement of the unit within the container.

Seal the container with strong tape or metal bands.

Mark the container "FRAGILE-DELICATE INSTRUMENT" to ensure careful handling.

Be certain that all correspondence refers to full instrument nomenclature, model and serial number.

2.4 POWER REQUIREMENTS

The Model 624XA Series Frequency Counters are supplied with a standard three conductor power cable which, when connected to an appropriate power receptacle, grounds the chassis to protect operating personnel from certain electrical hazards. Whenever the cord is mated to a two-conductor outlet, a cord adapter plug (properly installed) must be used to provide the same protection. The instrument operates from either 100, 115, 125, 215, 225, 230 or 240 volts at 48 to 440 Hz and consumes approximately 17 watts of power. Taps on the power transformer are provided to accomodate various power levels. See drawing 05753201 for location of jumpers for appropriate line voltages.

Check to assure that the proper fuse is installed for the appropriate voltage before applying power to the instrument. A 0.50 ampere fuse is required for 100-115 volt operation and a 0.25 ampere fuse is required for 215-240 volt operation.

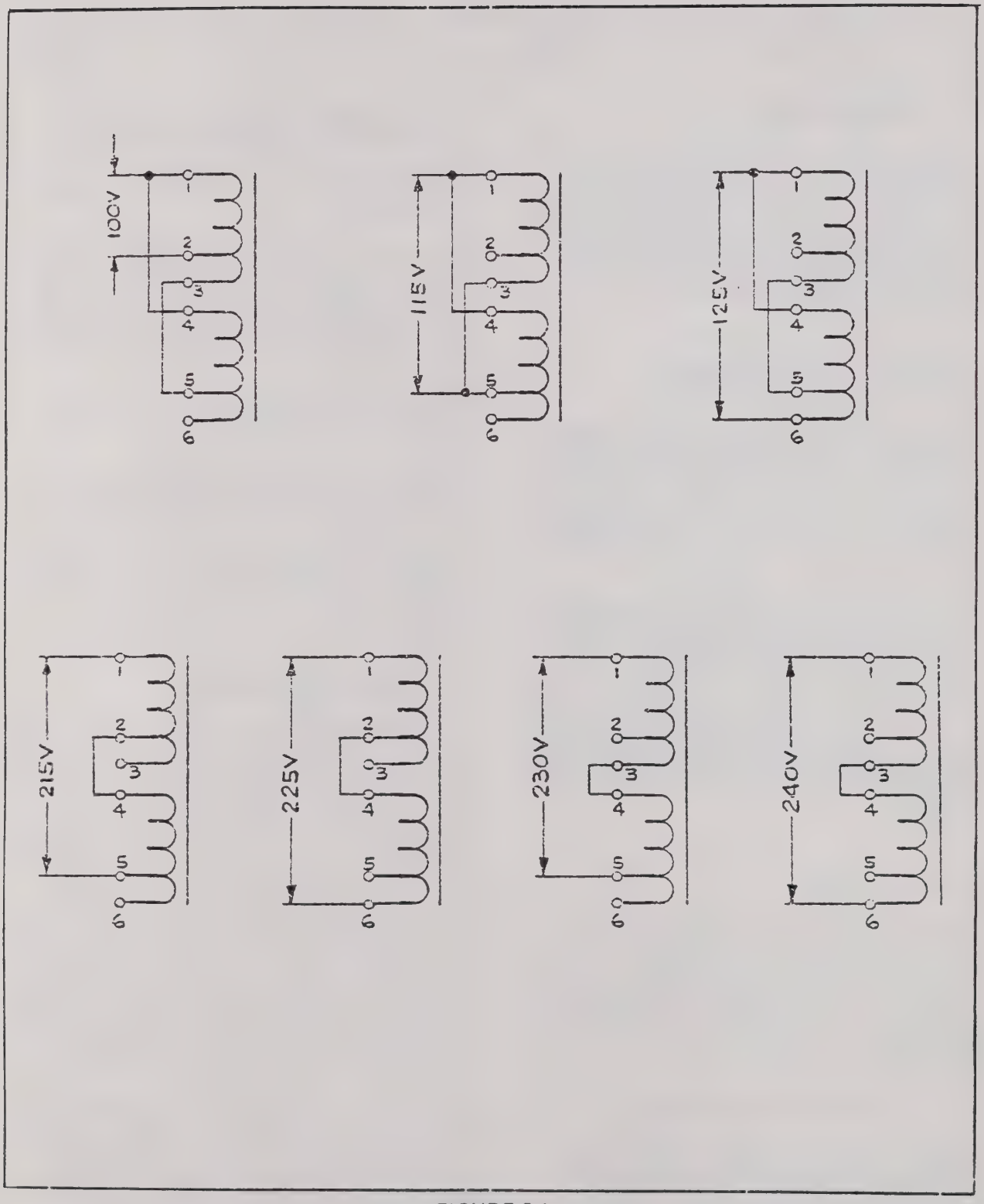


FIGURE 2.1
LINE CHANGE DIAGRAM POWER TRANSFORMER =05753201

CHAPTER 3

OPERATION

3.1 INTRODUCTION

This chapter describes the Model 624XA Series Frequency Counters front and rear panel controls and connectors. Initial turn on procedures and a general operational procedure for the three frequency measurement functions are also presented.

3.2 FRONT PANELS

Table 3.1 describes the controls, connectors and indicators on the front panels. Location of these controls, connectors and indicators is shown in Figure 3.1.

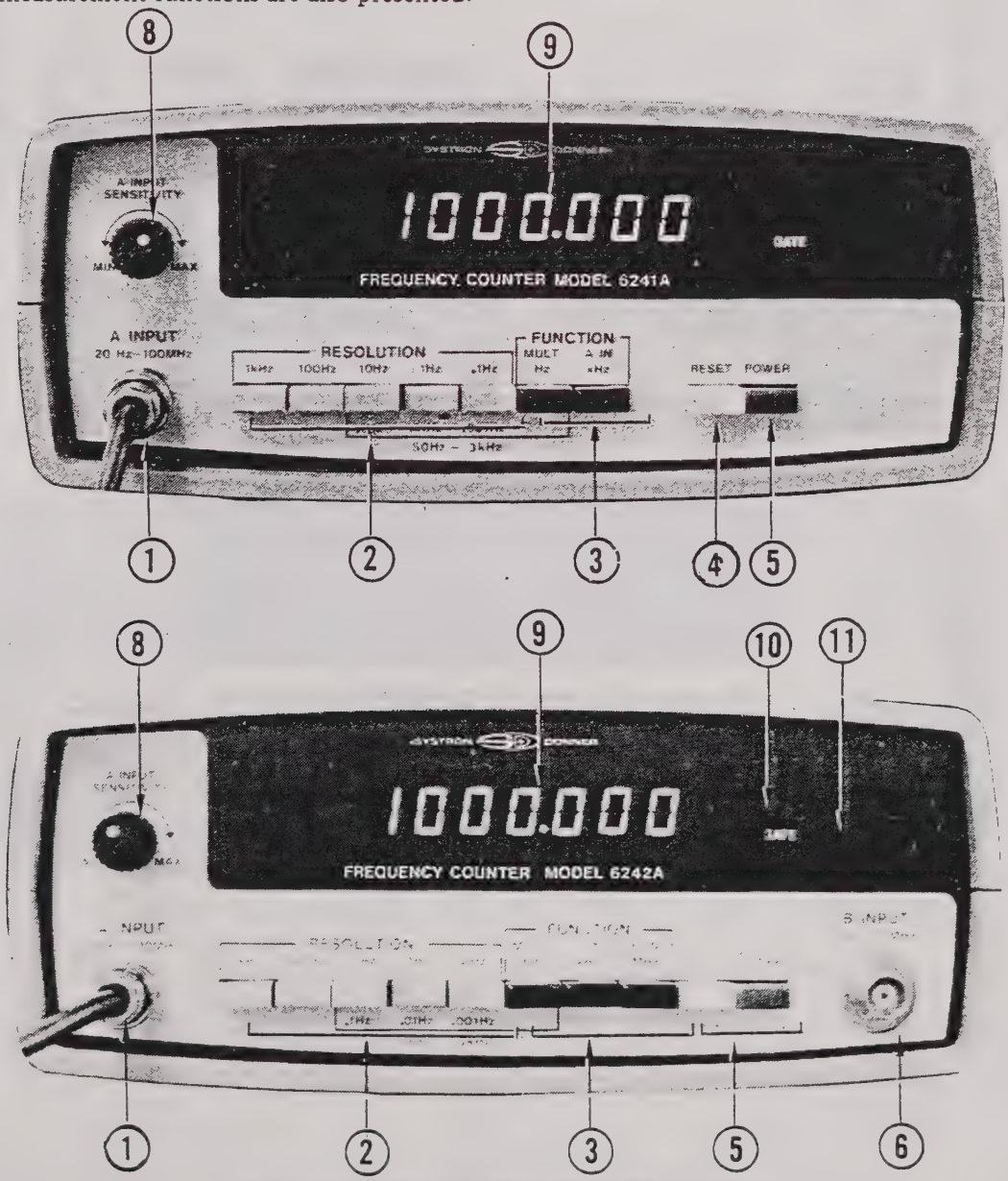


FIGURE 3.1 624XA SERIES FRONT PANELS

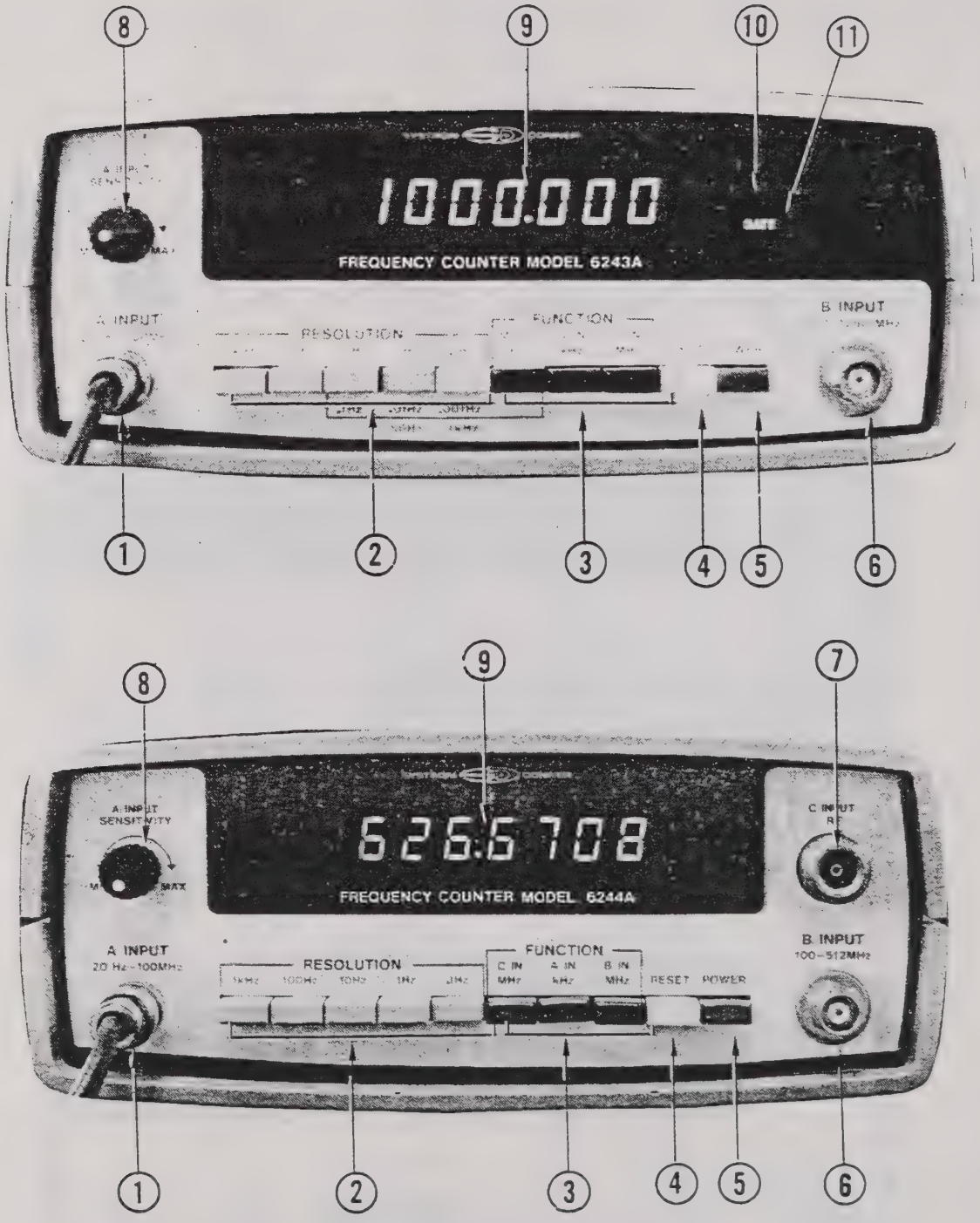


FIGURE 3.1 624XA SERIES PANELS (CONT)

TABLE 3-1 FRONT PANELS

INDEX	NAME	FUNCTION
1	A INPUT 20 Hz to 100 MHz	BNC Connector. A channel input accepts signals between 20 Hz and 100 MHz. Used for A IN and MULT. Functions.
2	RESOLUTION	Five interlocking push on switches. Used to select the measurement resolution from 0.1 Hz to 1 kHz in decade steps.
	1 kHz	When pressed this switch will disengage all other resolution switches and position the decimal point to provide 1 kHz resolution of the frequency measured. Used with A or B input signal but not in the Multiplier Function. For A inputs display reads XXXXXXXX. kHz, leading zeros, beyond the units kHz decade are suppressed. For B and C inputs display reads XXXXX.XXX MHz, leading zeros beyond the units MHz decade are suppressed.
	100 Hz	When pressed this switch will disengage all other resolution switches and position the decimal point to provide 100 Hz resolution of the frequency measured. Used with A or B input signals but not in the Multiplier Function. For A inputs display reads XXXXXXX.X kHz, leading zeros beyond the units kHz decade are suppressed. For B and C inputs display reads XXXX.XXXX MHz, leading zeros beyond the units MHz decade are suppressed.

TABLE 3-1 FRONT PANELS (CONT)

INDEX	NAME	FUNCTION
2 cont	10 Hz	When pressed this switch will disengage all other resolution switches and position the decimal point to provide 10 Hz resolution of the frequency measured. Used in all three functions, A input, B input and Multiplier. For Multiplier A inputs display reads XXXXXXX.X Hz, leading zeros beyond the units Hz decade are suppressed, For A inputs display reads XXXXXX.XX kHz leading zeros beyond the units kHz decade are suppressed. For B and C inputs display reads XXX.XXXXX MHz, leading zeros beyond the units MHz decade are suppressed.
	1 Hz	When pressed this switch will disengage all other resolution switches and position the decimal point to provide 1 Hz resolution of the frequency measured. Used in all three functions, A input, B input, and Multiplier. For Multiplier A inputs display reads XXXXXX.XX Hz, leading zeros beyond the units Hz decade are suppressed. For A inputs display reads XXXXX.XXX kHz, leading zeros beyond the units kHz decade are suppressed. For B inputs display reads XX.XXXXXX MHz, leading zeros beyond the units MHz decade are suppressed.

TABLE 3-1 FRONT PANEL (CONT)

INDEX	NAME	FUNCTION
2 cont	.1 Hz	When pressed this switch will disengage all other resolution switches and position the decimal point to provide 0.1 Hz resolution. Used in all three functions, A Input, B Input, and Multiplier. For Multiplier A inputs display reads XXXXX.XXX Hz, leading zeros beyond the units Hz decade are suppressed. For A inputs display reads XXXX.XXXX kHz, leading zeros beyond the units kHz decade are suppressed. For B inputs display reads X.XXXXXXX MHz.
3	FUNCTION	Three interlocking push on switches. Selects one of three operating functions within two frequency ranges.
	A IN kHz	A Input frequency range function switch. Accepts input frequencies from 20 Hz to 100 MHz. When pressed this switch will disengage all other function switches and program the instrument to accept A input signals. Frequency readout is direct reading in kHz.
	MULT. Hz (Opt. 45)	Low Frequency Multiplier mode function switch (Models 6241A, 6242A, and 6243A) Optional. When pressed this switch will disengage all other function switches and program the logic circuits to accept A input signals via the multiplier circuits. Frequency readout is direct reading in Hz.
	B IN MHz	B input frequency range function switch (Models 6242A, 6243A and 6244A) accepts

TABLE 3-1 FRONT PANEL (CONT)

INDEX	NAME	FUNCTION
3 cont	B IN MHz (Cont)	input frequencies from 100 MHz to 512 MHz (Models 6242A and 6244A) or 100 MHz to 1250 MHz (Model 6243A). When pressed this switch will disengage all other function switches and program the instrument to accept B input signals. Frequency readout is direct reading in MHz.
	C IN MHz	C input frequency range function switch (Model 6244A). Accepts input frequency from 500 MHz to 4.5 GHz. When pressed this switch will disengage all other function switches and program the instrument to accept C input signals. Frequency readout is direct reading in MHz.
4	RESET	Reset switch. Momentary push to hold switch when pressed, will reset the instrument to a zero state and initiate a new measurement cycle.
5	POWER	Push-on push-off switch applies power to the instrument.
6	B INPUT 100-512 MHz (6242A and 6244A) 100-1250 MHz (6243A)	BNC connector B channel input accepts signals between 100 MHz and 512 MHz for the Models 6242A and 6244A or 100 MHz to 1250 MHz for the Model 6243A. Used in the B IN function. Fuse protected connector is also the fuse holder, fuse in series with the input coax cable.
7	C INPUT RF	Type "N" connector C channel input accepts signals between 500 MHz and 4.5 GHz for the Model 6244A ACTO input. PIN diode leveler protected.
8	A INPUT SENSITIVITY	A potentiometer control that adjusts the sensitivity of the A

TABLE 3-1 FRONT PANEL (CONT)

INDEX	NAME	FUNCTION
8 cont	A INPUT SENSITIVITY (Cont)	channel from 10 mVrms to ≈5 Vrms.
9	READOUT DIGITS	Eight digit numerical display with decimal point. Seven segment in-line digital readout LED's. Readout is controlled by the Function and Resolution switches with automatically positioned decimal and leading zeros suppression.
10	O.S.	Off-scale indicator. Light emitting diode indicates that one or more of the most significant digits are not displayed. The digits that are displayed, however, are correct.
11	GATE	Time base count gate indicator. Light-emitting diode indicates when the count gate is open or closed.

3.3 REAR PANEL

Table 3-2 describes the controls and connectors on the rear panel. Location of the controls and connectors is shown in Figure 3-2.

TABLE 3-2 REAR PANEL

INDEX	NAME	FUNCTION
1	LAMP TEST	Push button switch, push to hold, when pressed illuminates all segments of all eight digits.
2	Fuse holder	Power fuse, 0.25 amp for 115 Vac operation and 0.125 amp for 230 Vac operation.

TABLE 3-2 REAR PANEL (CONT)

INDEX	NAME	FUNCTION
3	Receptacle	Power receptacle mates with three conductor power cord, supplied with unit.
4	INT EXT	Toggle switch selects either internal time base oscillator or external oscillator.
5	CLOCK IN	BNC connector used to inject external time base oscillator signal. When INT EXT switch is in the EXT position.
6	OSC. ADJ.	Rear panel access to permit calibration of the internal time base oscillator.
7	CLOCK OUT	BNC connector. Convenience 1 MHz Time Base Clock Output jack. 1 MHz TTL logic output through 470 ohm.
8	RUN HOLD	Toggle switch controls measurement rate of instrument. In the Run position the instrument makes continuous measurement samples of the input and the visual diaplay is updated after each measurement cycle. In the Hold position the instrument is locked up and requires a Reset to initiate a measurement. One measurement cycle per manual reset and the visual display holds this reading until the next cycle is initiated.
9	BCD	Digital Output connector plate. If Option 35 is installed provides connector for BCD Output of frequency readout plus decimal point and measurement units of Hz, kHz, or MHz. See Table 3.3 for pin number configuration and function.

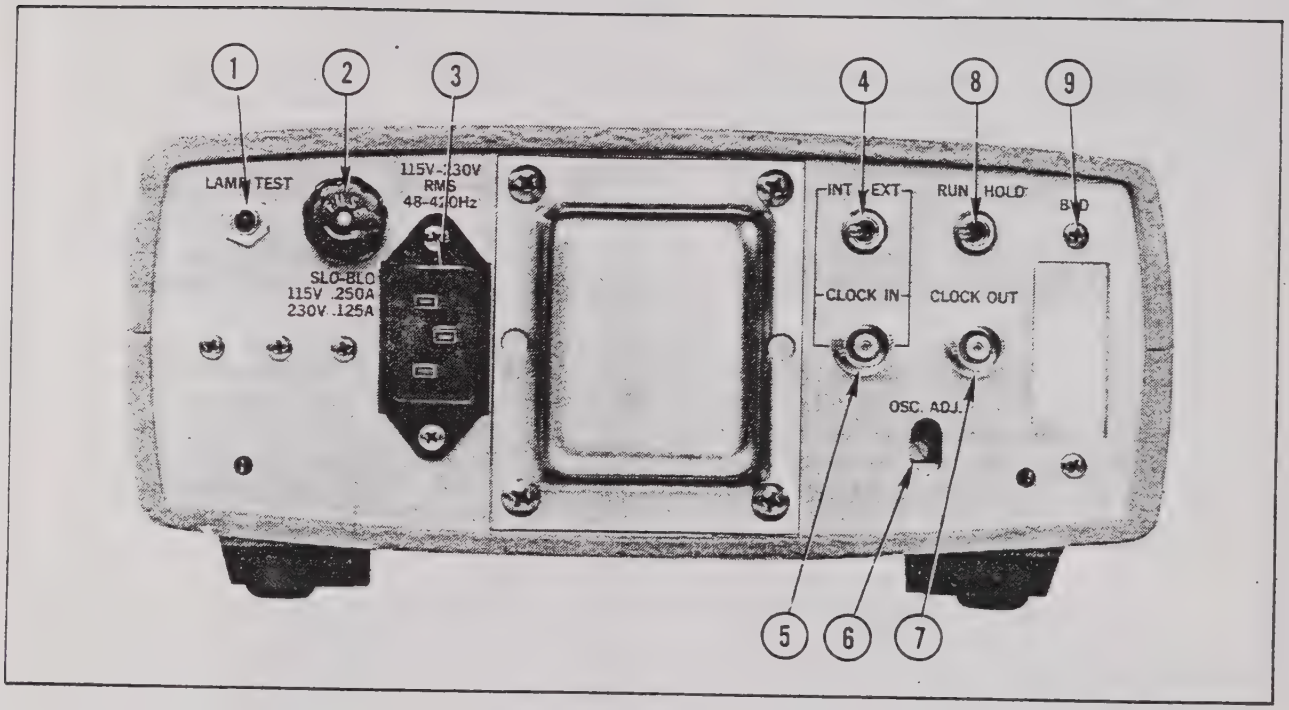


FIGURE 3-2 624XA SERIES REAR PANEL

3.4 OPERATING PROCEDURES

There are four operating functions within three frequency bands which can be measured by the 624XA series counters. The 20 Hz to 100 MHz band is used in conjunction with the Multiplier (optional) and A input functions. 100 MHz to 1250 MHz (Model 6243A) or 100 MHz to 512 MHz (Model 6242A) is measured in the B function. 500 MHz to 4.5 GHz (Model 6244A) is measured in the C function. Resolution for the A input, B input or C input functions is switch selectable, 0.1 Hz through 1 kHz in decade steps.

Resolution for the Multiplier function, is also switch selectable, from 0.001 Hz to 0.1 Hz using the 0.1 Hz, 1 Hz and 10 Hz resolution switches respectively. In the A input function the input signal amplified and then counted directly for a readout in kHz. In the Multiplier function the input signal is first processed by a phase locked X100 multiplier and then coupled to the counter circuits for an expanded readout in Hz. In the B input function the input signal is prescaled by a factor of four (Model 6242A) or a factor of sixteen (Model 6243A) then coupled to the counter circuits for a readout in MHz. In the (C input

function the input signal is processed by the ACTO (Automatic Computing Transfer Oscillator) circuits then routed to the counter circuits for a readout in MHz.

3.4.1 20 Hz - 100 MHz A Input (All Models)

To measure the frequency of a signal in this band two operating functions are available, A IN and the Optional Multiplier. Set the counter controls as follows:

Front Panel

POWER	Press on.
FUNCTION	Press A IN kHz.
RESOLUTION	Press 1 kHz, 100 Hz, 10 Hz or 0.1 Hz as appropriate for measurement desired.
RESET	Press to reset the instrument.
Signal Input	Connect to A INPUT connector. The display reads the input frequency, to the resolution selected, on a maximum of eight digits. All leading zeros however are suppressed.
A INPUT SENSITIVITY	Adjust the A INPUT SENSITIVITY control for appropriate signal.

Rear Panel

LAMP TEST	Press and hold, all segments on all eight digits of the readout display should illuminate. Release and display returns to normal.
INT EXT	Placed in INT position. If an external time base oscillator is desired, place switch in the EXT position and inject a 1 MHz 1 Vrms input to the clock IN connector.
RUN HOLD	RUN position: In the run position the instrument makes continuous measurements of the input signal, updating the display after each measurement cycle. HOLD position: In the hold position the instrument is locked up and must be reset manually each time a measurement is desired. The readout will hold the previously measured frequency until the reset switch is pressed.

3.4.2 Multiplier Function 50 Hz to 3000 Hz (All Models except 6244A)

Front Panel

POWER	Press On.
FUNCTION	Press MULT. Hz.
RESOLUTION	Press 10 Hz, 1 Hz or 0.1 Hz as appropriate for measurement resolution desired, 0.1, 0.01, or 0.001 respectively.
RESET	Press to reset instrument.
Signal Input	Connect to A INPUT connector. Frequency displayed is read in Hz. Display reads input frequency, to resolution selected on max. of eight digits. All leading zeros are suppressed.
A INPUT SENSITIVITY	Adjust the A INPUT SENSITIVITY control for appropriate signal.
Rear Panel	Rear panel controls operate as described for A INPUT paragraph 3.4.1.

3.4.3 100 MHz to 512 MHz (Model 6242A) or 100 MHz to 1250 MHz (Model 6243A) B INPUT

Front Panel

POWER	Press On.
FUNCTION	Press B IN MHz.
RESOLUTION	Press 1 kHz, 100 Hz, 10 Hz, 1 Hz or 0.1 Hz as appropriate for measurement desired.
RESET	Press to reset the instrument.
Signal Input	Connect to B INPUT connector. The display reads the

input frequency, to the resolution selected, on a maximum of eight digits. All leading zeros however are suppressed.

Rear Panel — Rear panel controls operate as described for A INPUT paragraph 3.4.1.

3.4.4 500 MHz to 4.5 GHz (Model 6244A Only)

Front Panel

POWER	Press On.
FUNCTION	Press C IN MHz.
RESOLUTION	Press 1 kHz, 100 Hz, 10 Hz, 1 Hz or 0.1 Hz as appropriate for measurement desired.
RESET	Press to reset instrument.
Signal Input	Connect to C INPUT RF connector. The display reads the input frequency, to the resolution selected, on a maximum of eight digits. All leading zeros however are suppressed.

Rear Panel — Rear Panel controls operate as described for A INPUT paragraph 3.4.1.

3.5 DIGITAL BCD OUTPUT (OPTION 35)

When Option 35 is installed a rear panel BCD 24 pin connector is provided. Table 3-3 provides pin number and signal coding information.

TABLE 3-3 BCD OUTPUT CONNECTOR

PIN	DESCRIPTION	PIN	DESCRIPTION
1	$\overline{\text{Sb } 10^7}$	13	DP BIT "1"
2	$\overline{\text{Sb } 10^6}$	14	DP BIT "2"
3	$\overline{\text{Sb } 10^5}$	15	DP BIT "4"
4	$\overline{\text{Sb } 10^4}$	16	$\overline{\text{PRINT COMMAND}}$
5	$\overline{\text{Sb } 10^3}$	17	$\overline{\text{RESET INHIBIT}}$
6	$\overline{\text{Sb } 10^2}$	18	MHz (Annunciator)
7	$\overline{\text{Sb } 10^1}$	19	Hz (Annunciator)
8	$\overline{\text{Sb } 10^0}$	20	kHz (Annunciator)
9	BCD BIT "1"	21	N.C.
10	BCD BIT "2"	22	N.C.
11	BCD BIT "4"	23	+5V Reference
12	BCD BIT "8"	24	OV Reference (GND)

Notes:
Sb = Strobe
DP = Decimal Point data
NC = Not Connected

CHAPTER 4

PRINCIPLES OF OPERATION

4.1 INTRODUCTION

This chapter describes the functional operations of the Model 624XA Series Frequency Counters from three perspectives. The overall functional operation is discussed first and is referenced to Figure 4-1 624XA Series Functional Schematic Diagram. This description covers the selection logic, the time base logic, the count gate logic, the reset/store logic and the counter circuits in detail that are located on the Main Logic PCB Assembly, and relates to their interface with the amplifier, prescaler, multiplier, ACTO, N Computer and display PCB Assemblies.

NOTE

Figure 4-1 relates to all Models of the 624XA series, which use a common Main Logic PCB Assembly. The configuration is changed for the different Models by placement of the jumper wires (W1, W2 and W3) and the change out of the plug-in PCB Assemblies A4, A5 and A6.

A detailed theory of operation of the six supporting PCB assemblies is presented next, and is referenced to the schematic diagrams located in Chapter 7 of the manual. The Integrated Circuit Modules used in the counter are listed and described as to their function and are supported by the IC data sheets (pages 5-11 through 5-45), which provides pinning information, schematic and logic equivalents and detailed characteristics that are unique to the IC device.

4.2 MAIN LOGIC PCB FUNCTIONAL DESCRIPTION

The measurement technique used is the comparison of the unknown input signal frequency to a known time base derived from the resolution selection of the time base reference oscillator. Four functional modes of operation are provided which are front panel switch selected;

1. Direct Counting from 20 Hz to 100 MHz (all Models).

2. Prescaler (÷16) Counting from 100 MHz to 1.25 GHz (Model 6243A) or Prescaler (÷4) Counting from 100 MHz to 512 MHz (Model 6242A).

3. Multiplier (X100) Counting from 50 Hz to 3 kHz (available when Option 45 is installed in all Models except 6244A).

4. ACTO (Automatic Computing Transfer Oscillator) Counting from 500 MHz to 4.5 GHz (Model 6244A only).

4.2.1 A Input Mode Of Operation

The A Input Mode provides for the direct counting of 20 Hz to 100 MHz signal that are amplified and converted to a digital ECL signal by the amplifier PCB assembly A1. This digital serial pulse train is then directed to the counter circuits when the A Input Count Gate U4-14 is enabled by the FUNCTION A IN kHz switch, and opened by the selected time base. The serial data count is accumulated by the counter during the count cycle (time base period). This total count is then converted to a BCD format by the counter circuits (U5, U12, U18 and U6) and applied to the Display PCB Assembly A2 during the Store (transfer) cycle to provide a readout of the count in kHz.

4.2.2 B Input Mode Of Operation (Model 6243A)

The B Input Mode provides for a divide by 16 prescaler counting of 100 MHz to 1.25 GHz signals that are amplified, divided by 16 and converted to a ECL digital signal by the prescaler PCB Assembly A4. This serial pulse train is then directed to the counter circuits when the B Input Count Gate (U4-3) is enabled by the FUNCTION B IN MHz switch, by placing a ECL logic high (-5.2V) on U4 pin 7, and opened by the selected time base which is divided by 16. The serial data count is

then accumulated by the counter circuits during the count cycle. This accumulated count is then converted to a BCD format by the Counter Circuit (U5, U12, U18 and U6) and applied to the Display PCB Assembly A2 during the Store cycle to provide a readout of the count in MHz.

4.2.3 B Input Mode Of Operation (Models 6242A and 6244A)

The B Input Mode provides for a divide by four prescaler counting of 100 MHz to 512 MHz signals that are amplified, divided by four and converted to a ECL digital signal by the prescaler PCB Assembly A4. This serial pulse train is then directed to the counter circuits when the B Input Count Gate (U4-3) is enabled by the FUNCTION B IN MHz switch by placing a ECL logic high (-5.2V) on U4 pin 7 and opened by the selected time base which is divided by four. The serial data count is then accumulated by the counter circuits during the count cycle. This accumulated count is then converted to a BCD format by counter circuit (U5, U12, U18 and U6 and applied to the Display PCB Assembly A2 during the Store cycle to provide a readout of the count in MHz.

4.2.4 Multiplier (Option 45) Mode Of Operation (All Models except 6244A)

The Multiplier Mode (Option 45) provides a times 100 multiplication of the low frequency 50 Hz to 3 kHz output of the Amplifier PCB Assembly A1 (OUT LF signal) by the Multiplier PCB Assembly A5. This MULT OUT signal is a x100 A input 5 kHz to 300 kHz serial count which is directed to the counter circuits when the Multiplier Count Gate (U4-15) is enabled by the FUNCTION MULT Hz switch, by placing a ECL logic high (-5.2V) on U4 pin 13 and opened by the selected time base. This serial count is then accumulated by the counter circuits during the count cycle. The accumulated count is then converted to a BCD format by the counter circuits (U5, U12, U18 and U6) and applied to the display during the Store cycle to provide a readout of the count in Hz.

4.2.5 C Input (ACTO) Mode Of Operation (Model 6244A)

The C Input Mode provides for a ACTO (Automatic Computing Transfer Oscillator) counting of 500 MHz to 4.5 GHz signals. When the Model 6244A is configured the N Computer PCB Assembly is installed in the A5 location replacing the Option 45 Multiplier PCB Assembly and the ACTO PCB Assembly A6 is installed.

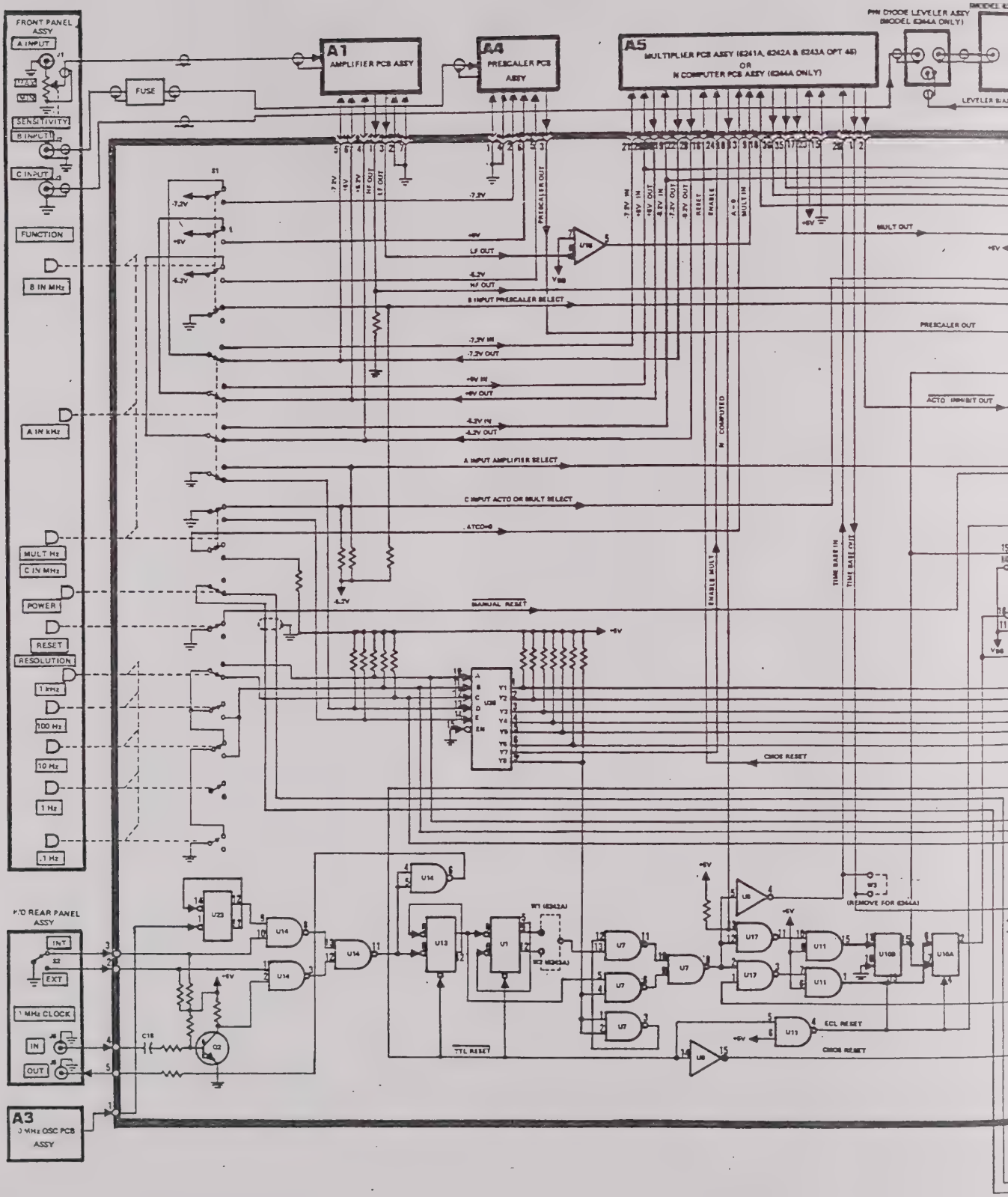
The signal to be counted is applied to the C INPUT "N" type connector (J3) and routed via a semiridged coax cable to the PIN Diode Leveler Assembly. This signal is then leveled by a level bias control signal generated by the level detector logic located on the ACTO PCB Assembly A6. The PIN Diode Leveler outputs the leveled 500 MHz to 4.5 GHz input signal to the Dual Sampler Assembly which is part of the ACTO Assembly A6 via a semiridged coax cable.

The ACTO PCB and N COMPUTER PCB logic which inter-react generate two outputs; one being the ACTO OUT signal which is the phase locked ACTO local oscillator frequency which is applied to Count Gate U4 pin 12 to allow it to be counted by the counter circuits. The other is the TIME BASE OUT from A5 pin 1 which is a ACTO time base clock frequency that relates the computed X N number.

4.2.6 Function And Resolution Select Logic

When the A IN kHz push button of the FUNCTION switch is pressed and latched the following enable and inhibit operations are configured:

1. -5.2V ECL logic high (V_{ee}) is placed on U4 pin 10 to enable the A Input Count Gate.
2. +5V, -5.2V and -7.2V is applied to the Amplifier PCB Assembly A1 to enable Amplifier PCB for the A Input direct counting function.


FRONT PANEL ASSY
A INPUT
SENSITIVITY
B INPUT
C INPUT
FUNCTION
B IN MHz
A IN kHz
MULT Hz
C IN MHz
POWER
RESET
RESOLUTION
1 kHz
100 Hz
10 Hz
1 Hz
.1 Hz
A1 AMPLIFIER PCB ASSY
A4 PRESCALER PCB ASSY
A5 MULTIPLIER PCB ASSY (6241A, 6242A & 6243A OPT 48) OR N COMPUTER PCB ASSY (6244A ONLY)
PIN DIODE LEVELER ASSY (MODEL 6244A ONLY)
FUSE
S1
-7.2V
+8V
-4.2V
LF OUT
HF OUT
PRESCALER OUT
B INPUT PRESCALER SELECT
-7.2V IN
-7.2V OUT
+8V IN
+8V OUT
-4.2V IN
-4.2V OUT
A INPUT AMPLIFIER SELECT
C INPUT ACTO OR MULT SELECT
MANUAL RESET
CMOS RESET
TTL RESET
ECL RESET
MULT OUT
ACTO INHIBIT OUT
TIME BASE IN
TIME BASE OUT
ENABLE MULT
N COMPUTED
(REMOVE FOR 6244A)
P/O REAR PANEL ASSY
INT
EXT
1 MHz CLOCK
IN
OUT
A3 3 MHz OSC PCB ASSY

624XA-7-77

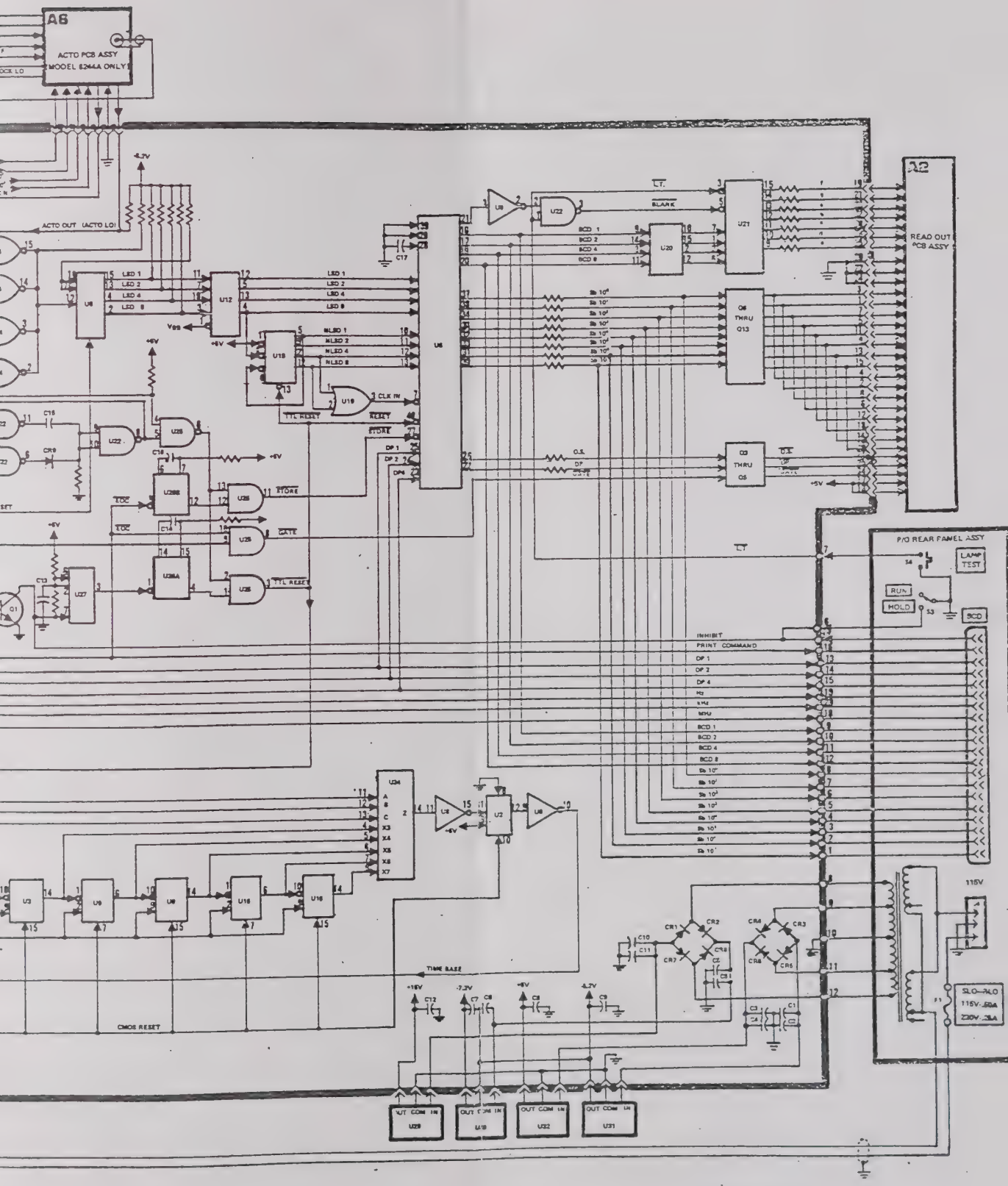


FIGURE 4-1
624XA SERIES
FUNCTIONAL SCHEMATIC DIAGRAM

3. The +5V, -5.2V and -7.2V is removed from the Prescaler PCB Assembly A4 to inhibit the Prescaler function.
4. A ECL logic low (0 volts) is set on pins 7 and 13 of U4 to disable the B Input and Multiplier Count Gates.
5. The $\overline{\text{MULT ENABLE}}$ line from U28 pin 7 is set at a TTL logic high (+5V) to inhibit the Multiplier functions.

When the MULT Hz push button of the FUNCTION switch is pressed and latched the following enable and inhibit operations are configured:

1. A -5.2V ECL logic high (V_{ee}) is set on pin 13 of U4 to enable the Multiplier Count Gate.
2. +5V, -5.2V and -7.2V is applied to the Amplifier PCB A1 and the Multiplier PCB A5 to enable the A1 and A5 PCB Assemblies for the MULT Hz function.
3. A ECL logic low (0 volts) is set on pins 10 and 7 of U4 to disable the A Input and B Input Count Gates.
4. The $\overline{\text{MULT ENABLE}}$ line from U28 pin 7 is set at a TTL logic low (0 volts) to enable the multiplier functions when the proper resolution is selected.

When the B IN MHz push button of the FUNCTION switch is pressed and latched the following enable and inhibit operations are configured:

1. A -5.2V ECL logic high (V_{ee}) is applied to pin 7 of U4 to enable the B Input Count Gate.
2. +5V, -5.2V and -7.2V is applied to the Prescaler PCB A4 to enable it's circuits for the B Input Prescaler operation.
3. The +5V, -5.2V and -7.2V is removed from assemblies A1 and A5 to inhibit the A Input and Multiplier functions in the case of Models 6242A and 6243A or the A Input and C Input ACTO functions in the case of Model 6244A.
4. U28 pin 9 will go to a TTL logic low (0 volts), which will enable gate U7-11 and disable gate U7-6 which in turn will decrease the duration of the selected time base by a factor of 4 if jumper W1 (6242A or 6244A) is installed, or by a factor of 16 if jumper W2 (6243A) is installed.

When the C IN MHz push button of the FUNCTION switch is pressed and latched the following enable and inhibit operations are configured for the Model 6244A:

1. A -5.2V ECL logic high (V_{ee}) is set on pin 13 of U4 to enable the ACTO Count Gate and allow counting of the ACTO OUT signal applied to U4 pin 12.
2. The +5V, -5.2V and -7.2V is removed from assemblies A1 and U4 to inhibit the A Input and B Input Functions.
3. +5V and -5.2V is applied to the N Computer PCB A5 and the ACTO PCB A6 to enable their circuits for the C Input ACTO operation.
4. Logic low (0 volts) are set on pins 13 and 14 of PROM U28 to allow ACTO operation by configurating the U28 Output of Y6=0, Y7=1 and Y8=1 logic states.
5. A logic high (+5V) is set on the ACTO=0 line (PCB Assembly A5 pin 13).

The RESOLUTION section of the push button switch interfaces with the A, B and C inputs of the PROM Incoder U28 (pins 10, 11 12) to allow for the selection of the time base (count gate duration) and the proper decimal point location on the display. The FUNCTION section of the push button switch also interfaces with the D and E inputs of the PROM Incoder U28 (pins 13 and 14) to allow for the encoding of the selected functional mode. Table 4-1 provides the incoding format of the RESOLUTION section of the push button switch as to it's logic function with it's relationship to the FUNCTION section of the switch.

The PROM Incoder U28's outputs Y1, Y2 and Y3 (pins 1, 2 and 3) provides a 1-2-4 octal code

TABLE 4-1 RESOLUTION AND FUNCTION INCODING

Switch Selection		U23 Prom Inputs					U24 Inputs			Count Gate Duration	Display Readout (all leading zeros beyond the unit decade are suppressed)
Resolution	Function	A	B	C	D	E	A	B	C		
.1 Hz	MULT IN Hz	1	1	1	1	0	1	1	1	10s	XXXXX.XXX Hz
.1 Hz	A IN kHz	1	1	1	0	1	1	1	1	10s	XXXX.XXXX kHz
.1 Hz	B IN MHz (6242A/6244A)	1	1	1	1	1	1	1	1	2.5s	X.XXXXXXX MHz
.1 Hz	B IN MHz (6243A)	1	1	1	1	1	1	1	1	625 ms	X.XXXXXXX MHz
.1 Hz	C IN MHz	1	1	1	0	0	1	1	1	10s + ACTO TB	X.XXXXXXX MHz
1 Hz	MULT IN Hz	0	1	1	1	0	0	1	1	1s	XXXXXX.XX Hz
1 Hz	A IN kHz	0	1	1	0	1	0	1	1	1s	XXXXX.XXX kHz
1 Hz	B IN MHz (6242A/6244A)	0	1	1	1	1	0	1	1	.25s	XX.XXXXXX MHz
1 Hz	B IN MHz (6243A)	0	1	1	1	1	0	1	1	62.5 ms	XX.XXXXXX MHz
1 Hz	C IN MHz	0	1	1	0	0	0	1	1	1s + ACTO TB	XX.XXXXXX MHz
10 Hz	MULT IN Hz	1	0	1	1	0	1	0	1	100 ms	XXXXXXX.X Hz
10 Hz	A IN kHz	1	0	1	0	1	1	0	1	100 ms	XXXXXX.XX kHz
10 Hz	B IN MHz (6242A/6244A)	1	0	1	1	1	1	0	1	25 ms	XXX.XXXXX MHz
10 Hz	B IN MHz (6243A)	1	0	1	1	1	1	0	1	6.25 ms	XXX.XXXXX MHz
10 Hz	C IN MHz	1	0	1	0	0	1	0	1	100 ms + ACTO TB	XXX.XXXXX MHz
100 Hz	MULT IN Hz	0	0	1	1	0	0	0	1	10 ms	COUNTING INHIBITED
100 Hz	A IN kHz	0	0	1	0	1	0	0	1	10 ms	XXXXXXX.X kHz
100 Hz	B IN MHz (6242A/6244A)	0	0	1	1	1	0	0	1	6.5 ms	XXXX.XXXX MHz
100 Hz	B IN MHz (6243A)	0	0	1	1	1	0	0	1	.625 ms	XXXX.XXXX MHz
100 Hz	C IN MHz	0	0	1	0	0	0	0	1	10 ms + ACTO TB	XXXX.XXXX MHz
1 kHz	MULT IN Hz	1	1	0	1	0	1	1	0	1 ms	COUNTING INHIBITED
1 kHz	A IN kHz	1	1	0	0	1	1	1	0	1 ms	XXXXXXXX. kHz
1 kHz	B IN MHz (6242A/6244A)	1	1	0	1	1	1	1	0	.25 ms	XXXXXXX.X MHz
1 kHz	B IN MHz (6243A)	1	1	0	1	1	1	1	0	62.5 µs	XXXXXXX.X MHz
1 kHz	C IN MHz	1	1	0	0	0	1	1	0	1 ms + ACTO TB	XXXXXXX.X MHz

to the decimal point location and leading zero suppression functions. U28's Y4, Y5 and Y6 outputs (pins 4, 5 and 6) provides the unit of measurement data (Hz, kHz or MHz) to the Option 35 BCD rear panel output connector. U28's Y7 output (pin 7) generates the $\overline{\text{MULT INHIBIT}}$ signal which is set to a TTL logic low (0 volts) to inhibit the X100 multiplier function when the 1 kHz or 100 Hz resolution is switch selected.

The Y8 output of U28 (pin 9) generates a logic low (0 volts) when the Prescaler B Input function is selected, which will enable gate U7-11 and disable gate U7-6 which will effect a decrease of the duration of the selected time base by a factor of 4 if jumper W1 (6242A or 6244A) is installed, or by a factor of 16 if jumper W2 (6243A) is installed. Table 4-2 provides a "Truth Table" of the U28 PROM Incode program.

4.2.7 Time Base Logic

The time base divider is referenced to the 10 MHz internal oscillator (A3) or a 1 MHz external 1 Vrms 500Ω reference source, which is switch selectable by the rear panel INT-EXT toggle switch S2. When the CLOCK IN INT-EXT is placed in its INT position a logic low is set on pin 10 of U14 and a logic high (+5V) is set on pin 1 of U14, which will gate on the internal time base oscillator signal at U14 pin 9, which is divided by 10 via counter U23 to 1 MHz, and gate inhibit the external 1 MHz signal which is applied from the CLOCK IN rear panel BNC connector J5 via transistor Q2. When the CLOCK INT-EXT switch S2 is placed in it's EXT position a logic high is set on U14 pin 1 and a logic low is set on U14 pin 10, which will gate enable the external 1 MHz signal applied to the CLOCK IN BNC connector J5 and gate inhibit the internal reference oscillator signal. NAND gate U14-6 provides the drive for the 1 MHz reference signal to the rear panel CLOCK OUT BNC connector J4, as a TTL (+5V peak) clock, this signal is referenced to either the internal oscillator or the external CLOCK IN signal depending on the position of the CLOCK IN INT-EXT switch S2.

The switch selected 1 MHz time base reference clock is applied to pin 6 of U13 a ÷10 counter. A 100 kHz clock is generated at U13 pin 5 which is applied to pin 8 of counter U1 and pin 5 of NAND gate U7. When the B IN MHz function is switch selected pin 9 of PROM U28 will go to a logic low state and set a logic low on U7 pin 4 and a logic high on U7 pin 12. This U7 gate configuration will enable the 25 kHz clock from U1 pin 9 when jumper W2 (6242A and 6244A) or the 6.25 kHz clock from U1 pin 12 when jumper W1 (6243A) is installed, and disable the 100 kHz clock for U13 pin 5. When the A IN kHz C IN MHz or MULT Hz function is switch selected pin 9 of PROM U28 will go to a logic high state which will enable the 100 kHz clock and disable the 6.25 kHz or 25 kHz clock at NAND gate U7 pin 8.

The selected 100 kHz, 25 kHz or 6.25 kHz clock at NAND gate U7-8 is applied via CMOS inverter U8-4 and jumper W3 (6241A, 6242A and 6243A) to the six decade ÷10 time base count chain comprised of three dual CMOS BCD counters U3, U9 and U15. Five outputs from 0.1 Hz to 1 kHz or (0.25 Hz to 25 Hz Models 6242A/6244A) or (.00625 Hz to 62.5 Hz Model 6243A) when the B IN MHz function is selected, are generated by the time base count chain and applied to the time base selector U24's X 3 through X 7 inputs (U24 pins 4 through 8). Table 4-3 provides the time base selection format as to the selected output at U24 Z output (pin 14).

The time base output at U24 pin 14 is applied to the clock input of CMOS flip-flop U2 via inverter U8-15 thus toggling the flip-flop at the selected time base rate. The flip-flop's Q output at pin 12 is inverted by U8-10 CMOS inverter and applied to pin 1 of gate U17 which is the time base input to the Count Gate Logic.

When the Model 6244A is configured jumper W3 is removed and the time base clock output at CMOS inverter U8 pin 4 is routed to the N Computer PCB A5 input pin 26. When the A or B input function is selected, the ENABLE signal at U28 Y7 will go to a logic low placing a logic low on the N Computer PCB A5 pin 24, which will allow the time base clock at A5 pin 1 to be the same as the clock presented at the time base input (A5, pin 26).

TABLE 4-2 U28 PROM PROGRAM (TRUTH TABLE)

FUNCTION SELECTED	RESOLUTION SELECTED	U28 INPUTS						U28 OUTPUTS							
		A	B	C	D	E	$\overline{EN}$	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8
A IN kHz	1 kHz	1	1	0	0	1	0	0	0	0	1	0	1	0	1
A IN kHz	100 Hz	0	0	1	0	1	0	1	0	0	1	0	1	0	1
A IN kHz	10 Hz	1	0	1	0	1	0	0	1	0	1	0	1	0	1
A IN kHz	1 Hz	0	1	1	0	1	0	1	1	0	1	0	1	0	1
A IN kHz	.1 Hz	1	1	1	0	1	0	0	0	1	1	0	1	0	1
B IN MHz	1 kHz	1	1	0	1	1	0	1	1	0	1	1	0	0	0
B IN MHz	100 Hz	0	0	1	1	1	0	0	0	1	1	1	0	0	0
B IN MHz	10 Hz	1	0	1	1	1	0	1	0	1	1	1	0	0	0
B IN MHz	1 Hz	0	1	1	1	1	0	0	1	1	1	1	0	0	0
B IN MHz	.1 Hz	1	1	1	1	1	0	1	1	1	1	1	0	0	0
MULT Hz	1 kHz*	1	1	0	1	0	0	0	1	0	0	0	1	0	1
MULT Hz	100 Hz*	0	0	1	1	0	0	0	0	0	1	1	1	0	1
MULT Hz	10 Hz	1	0	1	1	0	0	1	0	0	0	0	1	1	1
MULT Hz	1 Hz	0	1	1	1	0	0	0	1	0	0	1	1	1	1
MULT Hz	.1 Hz	1	1	1	1	0	0	1	1	0	0	1	1	1	1
C IN MHz	1 kHz	1	1	0	0	0	0	1	0	0	1	1	0	1	1
C IN MHz	100 Hz	0	0	1	0	0	0	0	0	1	1	1	0	1	1
C IN MHz	10 Hz	1	0	1	0	0	0	1	0	1	1	1	0	1	1
C IN MHz	1 Hz	0	1	1	0	0	0	0	1	1	1	1	0	1	1
C IN MHz	.1 Hz	1	1	1	0	0	0	1	1	1	1	1	0	1	1

*INVALID SELECTION, MULTIPLIER WILL BE INHIBITED BY U28 Y7 (pin 7) being set low (0 volts)

TABLE 4-3 TIME BASE SELECTION FORMAT

U24 SELECT CODE			COUNTER OUTPUT	TIME BASE FREQUENCY		
A (PIN 11)	B (PIN 12)	C (PIN 13)		A INPUT	B INPUT (6242A/6244A)	B INPUT (6243A)
1	1	0	U3 PIN 14	1 kHz	250 Hz	62.5 Hz
0	0	1	U9 PIN 6	100 Hz	25 Hz	6.25 Hz
1	0	1	U9 PIN 14	10 Hz	2.5 Hz	.624 Hz
0	1	1	U15 PIN 6	1 Hz	.25 Hz	.0625 Hz
1	1	1	U15 PIN 14	.1 Hz	.025 Hz	.00625 Hz

This TB OUT signal at A5 pin 26 is routed to the input of the time base count chain at U3 pin 3. When the C input function is selected, the ENABLE signal at U28 Y7 output will go to a logic high placing a logic high on the N Computer PCB A5 pin 24, which will configure the time base to a 100 kHz + ACTO TB signal. This ACTO time base signal will expand the selected time base period by the N factor to allow the counter to display the ACTO measured signal on the display.

4.2.8 Count Gate Logic

The Count Gate Logic consists of the time base input gates U17-3 and U17-11, gates U11-15 and U11-1 which function as CMOS to ECL translators, the ECL stop/start flip-flops U10 and the quad 3-input ECL NOR gate U4 which is the actual count gate.

The selected time base clock at inverter U8 pin 10 is applied to U17 pin 1 and is gated with the undivided time base clock from gate U7 pin 8. This undivided time base clock is also applied to pin 12 of U17. The clock at U17 pin 11 is translated from a CMOS (+5V) to an ECL (-5.2V) logic true by U11-15 gate and applied to the enable of the count gate start control flip-flop (U10 pin 11). The Q output of the start flip-flop (U10 pin 10) will generate the gate on signal as a logic high which is applied to the input pins 4 and 5 of U4 to enable the count gate. This start gate signal is also applied to the D input of the stop control flip-flop at U10 pin 6, the enable input U10 pin 6 receives the undivided clock from U17-3 via CMOS to ECL translator U11-1. The Q output of the stop control flip-flop at U10 pin 2 will generate the EOC signal which will close the count gate when it goes to a logic low on pin 9 of U4.

By synchronizing the selected time base clock with the undivided reference clock, any jitter or sluing that may have been generated by the time base counters is eliminated. Thus the count gate will open and close in reference to the undivided clock, but have the duration of the selected time base.

4.2.9 Reset-Store Logic

The Reset-Store Logic generates the $\overline{\text{STORE}}$, $\overline{\text{RESET}}$. RESET and $\overline{\text{GATE}}$ signals. The $\overline{\text{EOC}}$ signal from flip-flop U10 pin 2 is applied to pin 2 is applied to pin 10 of U16 which inverts and translates it from an ECL logic low to a TTL logic high at U16 pin 12 as a TTL EOC signal. The $\overline{\text{GATE}}$ signal from U10 pin 15 is applied to pin 15 of U16 which translates it without invertion to a TTL $\overline{\text{GATE}}$ signal. The EOC signal from U16 pin 12 and the $\overline{\text{GATE}}$ signal from U16 pin 13 ECL to TTL translators are gated by AND gate U25-8 to generate the $\overline{\text{GATE INDICATOR}}$ signal which is coupled via Darlington driver transistor Q5 to the Display PCB Assembly A2 to illuminate the GATE LED indicator for the duration of the count gate enable period.

The $\overline{\text{EOC}}$ signal via ECL to TTL translator U16-12 is also applied to the store one-shot M.V. at U26 pin 9, which will generate a $\approx 100\ \mu s$ duration pulse at its Q output (U26 pin 12). This store pulse is applied via AND gate U25-12 as the $\overline{\text{STORE}}$ signal to pin 27 of the Decade Counter IC U6. A logic low on pin 27 of U6 will cause the Counter to output the count accumulated during the count gate enable period as a 1-2-4-8 BCD.

The $\overline{\text{EOC}}$ signal at U16-12 is applied to the Reset Timer IC U27 via transistor Q1. The timer U27 will generate a logic high on its output (U27 pin 3) ≈ 2.5 seconds after the EOC time and trigger the reset one-shot M.V. at its A input (U26 pin 1). The reset one-shot M.V. Q output at U26 pin 4 is applied to pin 1 of AND gate U25 which generates the $\overline{\text{RESET}}$ signal at U25 pin 3. This $\overline{\text{RESET}}$ signal is applied to the following listed TTL counter IC's $\overline{\text{RESET}}$ pins to reset the effected counter to zero.

U6 pin 40	U1 pin 13
U18 pin 13	U13 pin 13

The $\overline{\text{RESET}}$ signal from U25-3 is also applied to pin 5 of U11 which inverts and translates the TTL $\overline{\text{RESET}}$ signal to an ECL RESET signal at its U11 pin 4 output. This ECL RESET signal is then applied to the following listed ECL IC's RESET pins to reset the effected counters and flip-flops.

U5 pin 9	U10 pin 13
U10 pin 4	

The CMOS time base divider circuits are reset by a RESET developed by inverter U8-15, which inverts the TTL $\overline{\text{RESET}}$ signal from U25 pin 3 and applies it to the following listed CMOS counters and flip-flop RESET pins.

U3 pin 7	U15 pin 7
U3 pin 15	U15 pin 15

U9 pin 7 U2 pin 10
U9 pin 15

The rear panel mounted RUN-HOLD switch S3 when placed in its HOLD position will set a logic ground on the collector of transistor Q1, which will inhibit the timer U27 and thus prevent the generation of a RESET on an EOC state. This HOLD function causes the counter to hold the last accumulated count until the RUN HOLD switch is returned to its RUN position or the front panel RESET push button switch is depressed. When the RESET push button switch is depressed, a logic low (ground is set on pins 4 and 5 of U22 which will trigger the one-shot M.V. configured by the three NAND gates of IC U22, and generate a $\overline{\text{RESET}}$ via AND gates U25-6 and U25-3.

4.2.10 Counter Circuits

The selected and gated serial count from the Count Gate U4 is applied to the 1st DCU ECL Counter U5 pin 12. The 1st DCU Counter U5 outputs a 1-2-4-8 BCD count which is translated from ECL to TTL logic levels by the Quad Translator U12. ECL to TTL Translator U12 outputs the TTL BCD to the LSD BCD inputs of the 40 pin Decade Counter U6 (pins 6, 5, 4 and 3). The LSD bit 8 is applied to the 2nd DCU TTL Counter U18 at its CLOCK 1 input pin 8. Counter U18 outputs a 1-2-4-8 BCD count to the NLSD BCD inputs of the 40 pin Decade Counter U6 (pins 10, 11, 12 and 13). The NLSD bits 4 and 8 are gated by OR gate U19-3 to generate the NLSD $\overline{\text{CARRY}}$ signal which is applied to U6 pin 7 the $\overline{\text{CLOCK IN}}$ input.

The Decade Counter U6 is controlled as to its Count-Store-Reset cycle by the $\overline{\text{STORE}}$ pulse applied to pin 27 and the $\overline{\text{RESET}}$ pulse applied to pin 40. A 1-2-4 octal coded Decimal Point input is applied to U6 pins 25, 24 and 23 to activate the decade counter's decimal point and leading zero suppression internal circuits.

The Decade Counter outputs multiplexed eight decade display data in a 1-2-4-8 BCD format (U6 pins 16, 17, 19 and 20) to the BCD-to-Seven-Segment Decoder Driver U21 via Quad Buffer U20. The multiplexing frequency is determined by timing capacitor C17, which is connected between ground and pin 28 of U6 to control the frequency of U6's internal free-running M.V.

An eight line sequenced decade enable, timed to illuminate the LED display is applied to the Display PCB Assembly A2 via eight P-N-P Darlington transistors (Q6 through Q13) from the Decade Counter at pins 37, 38, 34, 36, 32, 33, 31 and 30 in decending order from decade 10^7 to 10^0. When the Decade Counter exceeds a count of 99999999 a logic high is generated at U6 pin 26 which will illuminate the Displays O.S. LED indicator via P-N-P Darlington transistor Q4.

4.2.11 Power Supply Circuits

The power supply consists of the rear panel mounted Power Transformer T1, line fuse F1, the AC Power input connector J3 and the four Voltage Regulators U29 through U32. The rectifiers and filter capacitors are located on the Main Logic PCB with the POWER push button switch which is part of S1.

The bridge rectifier consisting of CR3 through CR6 supplies raw negative voltage to the -5.2 volt regulator U31 and positive raw voltage to the +5 volt regulator U32. Fullwave rectifier consisting of CR1 and CR8 supplies raw negative voltage to the -2 volt regulator U30. Voltage regulator U30 is referenced to the -5.2 volt output of voltage regulator U31 so that its output as referenced to ground is -7.2 volts. Fullwave rectifier consisting of CR2 and CR7 supplied raw positive voltage to the Option 10 voltage regulator U29 which furnishes regulated +15 volts to the optional time base oscillator.

4.3 READOUT (DISPLAY) PCB ASSEMBLY A2

The following description is referenced to Figure 7-11 Readout PCB Assembly Schematic Diagram #7-05756801A located in Chapter 7 of this manual.

The Display PCB Assembly A2 interfaces with the Main Logic PCB via 34 pin DIP connector/ribbon cable assembly. The display consists of eight Seven Segment LED numerical display elements DS1 through DS8 and two LED indicators DS9 and DS10 to provide the GATE and O.S. (overscale)

indications. The eight line sequenced decade enables timed to illuminate the LED numerical display is applied via the connector/ribbon cable assembly as a +5V true (enable). The multiplexing of the numerical display is in decending order from decade 10^7 to 10^0.

The seven segment drive (ground returns) are applied via the cable assembly to the eight numerical display elements in parallel. Pin 25 of the cable assembly provides the decimal point drive as a ground return to each of the eight display elements in parallel. The O.S. LED (DS9) is illuminated when a logic low is set on pin 27 of the cable assembly and the GATE LED (DS10) illuminates when a logic low is placed on pin 34.

4.4 100 MHz AMPLIFIER PCB ASSEMBLY A1

The following description is referenced to Figure 7-9 100 MHz Amplifier PCB Schematic Diagram #7-05723801D, located in Chapter 7 of this manual.

The Amplifier PCB Assembly A1 interfaces with the Main Logic PCB via a seven pin connector. When the A INPUT or MULT Hz function is switch selected +5V, -5.2V and -7.2V is applied to connector pin 6, 4 and 5 respectively to enable the amplifier. When the B INPUT MHz function is switch selected the amplifier is disabled by the removal of the +5V, -5.2V and -7.2V.

The +5V V_{CC} provides voltage to the drain of the input FET Q1 via transistor Q3 which functions as a constant current source, the +5V is also applied to one side of potentiometer R7. The -7.2V input at the edge connector pin 5 is applied to U3 a -5 V IC voltage regulator which supplied -5V V_{ee} t o the FET Q1, emitter follower Q2 and t he triple ECL differential amplifier U1. The -5.2V at the edge connector pin 4 supplies V_{ee} to the second triple ECL differential amplifier U2.

The A INPUT 20 Hz to 100 MHz signal is applied via coax cable from the front panel A INPUT BNC connector and its seriesed SENSITIVITY control R101 to the PCB assembly coax connector P1 and capacitor coupled via C1, C2, C3 and R1 to gate #1 of the input FET Q1. Diodes CR1 and CR2 provides for the front end overload protection. The FET input provides high input impedance ($\geq$1 MΩ/25 pF) and low noise. The FET Q1 outputs at its source to emitter follower Q2 which is capacitor coupled by C8 to pin 9 of U1.

U1 is configured as a three stage cascaded amplifier the three unused complementary outputs pins 15, 2 and 7 are grounded. The last stage of U1 outputs at pin 3 which is dc coupled to pin 9 of U2.

U2 is configured as a three stage cascaded amplifier, the unused complementary output of the first stage pin 7 is grounded. The compelmentary output of the second stage pin 15 provides the feedback to the input of U1 pin 9 via resistors R31 and R6. Potentiometer R7 provides the adjustment of the feedback level, thus setting the overall all gain of the amplifier. It is normally adjusted to provide a 10 mVrms sensitivity for the A input, when the front panel SENSITIVITY control is set to MAX. The third stage provides complementary outputs to the Main Logic PCB Assembly via the edge connector J1 pins 3 and 1. Connector J1 pin 3 L.F. OUT provides a signal to the Multiplier PCB Assembly via a ECL to TTL logic translator U16-5 located on the Main Logic PCB. Connector J1 pin 1 H.F. OUT is applied to the input of the count gate U4 pin 11 located on the Main Logic PCB.

4.5 MULTIPLIER PCB ASSEMBLY (OPTION 45)

The following description is referenced to Figure 7-7 Logic PCB Schematic Diagram #7-05710001D and Figure 7-27 Multiplier PCB Schematic Diagram #7-05757401A.

The Multiplier PCB Assembly is installed when Option 45 is ordered. It provides high speed direct measurement in Hz of signals from 50 Hz to 3000 Hz, by multiplying the A input signal by a factor of 100. The X100 multiplier utilizes a phase locked loop and provides readout resolution from 0.001 Hz to 0.1 Hz selectable in three decade steps.

The Multiplier PCB Assembly A5 interfaces with

the Main Logic PCB via a 36 pin connector XA5.

When the MULT Hz function is selected with the 10 Hz, 1 Hz or .1 Hz resolution the PROM U28 on the Main Logic PCB will output a logic high on its Y7 output (U28 pin 7) as an ENABLE which is applied to the edge connector pin 24 of the Multiplier Assembly A5. Which will enable the "M" OUT signal at A5 pin 17 by enabling NAND gate U4-4 by setting a logic high on its input pin 6. The ENABLE signal is also inverted by U6-2 and applied to the dual flip-flop U5 resets (U5 pins 4 and 10) to enable the error detection circuit.)

The Amplifier PCB Assembly A1 outputs the LF OUT signal to the Main PCB where its converted from ECL (-5.2V) to a CMOS compatible logic level (+5V) by logic level translator U16-5 located on the Main Logic PCB. It is then applied to pin 9 of A5 edge connector as the "M" signal.

Two outputs are generated by the Multiplier PCB Assembly A5 and supplied to the Main Logic PCB Assembly, the "M" OUT and the $\overline{\text{INHIBIT OUT}}$. The "M" OUT signal a 5 kHz to 300 kHz count is routed to the Main Logic PCB Count Gate U4 pin 12 via connector XA5 pin 17 and logic translator U11-4, which translates it to an ECL level. The $\overline{\text{INHIBIT OUT}}$ signal at connector XA5 pin 2 is applied to the Main Logic PCB Assembly AND gate U25 pin 4 to reset the Counter circuits if a Multiplier error is detected.

The following detailed circuit analysis of the Multiplier is referenced to Figure 7-15. The "M" IN signal is applied via edge connector pin 9 and capacitor coupled by C5 to the Phase Comparator input U2-pin 14, where it is phase referenced to the signal from the second ÷10 Counters Q4 output (U3 pin 14) applied to U2 pin 3. The Phase Comparator outputs a digital error signal at U2 pin 13 which controls the VCO to maintain phase lock of the X100 Multiplier.

This output control voltage at U2 pin 13 is applied to the VCO input U2 pin 9 via external resistor R5. The VCO will track over a range of 50 Hz to 3 kHz. Capacitors C3 and C4 which are paralleled across U2 pins 6 and 7 are the frequency determining components of the VCO. Potentiometer R6 MAX adjustment provides for the setting of the upper tuning limit of the VCO, which is adjusted at test for a VCO maximum of 3 kHz. Potentiometer R7 MIN adjustment provides for the setting of the lower tuning limit of the VCO, and is adjusted at test for a VCO minimum of 50 kHz. The VCO output at U2 pin 4 is applied to pin 2 of U3, the $\overline{\text{ENABLE}}$ input of a dual BCD up-counter. The counter will increment on the negative going transition of the applied VCO signal. The Q4 output of the first counter (U3 pin 6) is connected to the $\overline{\text{ENABLE}}$ input of the second counter (U3 pin 10), and a ÷100 count is obtained at the second counter's Q4 output (U3 pin 14). This VCO ÷100 signal from U3 pin 14 is "looped back" to the Phase Comparator's U2 pin 3 to provide the phase lock loop function.

The circuitry containing the Dual One-Shot M.V. (U1), R-S Flip-Flop comprised of NAND gates U4-3 and U4-11, and the Dual Type D Flip-Flop (U5) provides a multiplier error detector, which will generate the $\overline{\text{INHIBIT OUT}}$ signal at XA5 pin 2 to reset the Counter whenever a multiplier error is detected. The error detection is enabled when the ENABLE signal at connector XA5 pin 24 is set to a logic high, which is inverted by U6-2 to place a logic low on the resets of the Dual D Type Flip-Flops (U5 pins 4 and 10). The ÷100 VCO signal from U3 pin 14 is applied to pin 12 of the Dual One-Shot M.V. U1. The "M" IN signal is inverted by U6-12 and applied to the other One-Shot M.V. input at U1 pin 4. The Dual One-Shot M.V. generates complimentary ≈1 μs duration pulses for each input transition of the input signals. The Dual One-Shot Q outputs U1 pins 6 and 10 are applied to the clock inputs of the Dual D Type Flip-Flops (U5 pins 3 and 11). The Q outputs of U1 (pins 7 and 9) are applied to the R-S Flip-Flop configured by the cross coupled NAND gates U4-3 and U4-11. The R-S Flip-Flop outputs a complimentary set-reset to the D inputs of U5 at pins 5 and 9. The Q outputs of the Dual D Flip-Flop (U5 pins 2 and 12) are applied to NAND gate U4-10, which will gate detect any error generated by the X100 multiplier function; such as a drop out of a count bit, or loss of phase lock and error flag it as a logic high at U4 pin 10. Inverter U6-10 inverts this error flag to a $\overline{\text{INHIBIT OUT}}$ logic low which is applied to the Main Logic PCB via connector XA5 pin 2, which will reset the

counter functions upon any multiplier error detection.

4.6 1.25 GHz PRESCALER PCB ASSEMBLY A4 (MODEL 6243A)

Two 1.25 GHz Prescalers are in production; they are directly interchangeable, and can be replaced with one another without changes to instrument operation and or specifications.

The following description is referenced to Figure 7-19 1.25 GHz Prescaler PCB Schematic Diagram #7-05706601 and Figure 7-21 1.25 GHz Prescaler PCB Schematic Diagram #7-06725901, located in chapter 7 of this manual. Circuit description is in respect to figure 7-19. Minor circuit differences because of different IC's employed, U1 and U2, are obvious and therefore only one prescaler is described.

The Prescaler PCB Assembly interfaces with the main Logic PCB Assembly via a 6-pin connector XA4.

When the B INPUT MHz function is switch selected +5V, -5.2V and -7.2V is applied to the edge connector pin 6, 5 and 2 respectively to enable the Prescaler. When the A INPUT kHz or MULT Hz function is switch selected the Prescaler is disabled by the removal of the +5V, -5.2V and -7.2V from the edge connector.

The 100 MHz to 1.25 GHz B INPUT from the front panel BNC connector is applied via in-line fuse F1 (connector J2 provides for the fuse holder which is in series with the input coax cable) and coax cable to coax connector P1. The signal is capacitor coupled by C1, C2 and C3 to the base of Q1. Resistor R1 terminates the input to ground to provide 50Ω input impedance. Diode CR1 and CR2 provides for the front end overload protection.

Transistors Q1 through Q6 configures a broadband low noise high gain amplifier chain. The last transistor in the chain Q6 functions as an emitter follower, which is capacitor coupled via C21 and C22 to the first divide-by-four counter clock input at U1 pin 4.

Two UHF ECL counters U1 and U2 divides the B input by a factor of 16. The Q of the first divider outputs a ÷ by 4 signal to the clock input of the second counter at U2 pin 4. The Q output of the second counter U2 pin 3 outputs a ÷ by 16 signal to pin 3 of the edge connector which provides the prescaled B input signal (÷16) to the count gate input on the Main Logic PCB at U4 pin 6.

Potentiometer R13 V_{ee} ADJ provides for the adjustment of the V_{ee} level to U1 pin 5 from -7.2V to -5.0V and is adjusted during test to achieve optimum count down operation of counter U1.

Diode CR5 and capacitor C23 provides a dc level detector circuit, which outputs a dc level that is proportional to the average amplitude of the signal being applied to the clock input of counter U1. This detected dc level is applied to the inverted input of the differential voltage comparator U3 pin 3. The non-inverted input of the voltage comparator U3 pin 2 is connected to the swinger of potentiometer R22 SENSE adjustment. Potentiometer R22 is adjusted at test to a dc level that is equal to a dc level that relates to a 10 mV rms (-27 dBm) B input signal, thus in effect sets the prescaler threshold (sensitivity). When the dc level at U3 pin 3 is equal to or greater than the level at U3 pin 2 set by potentiometer R22, U3 pin 7 will go low and turn off the Darlington P-N-P transistor Q7 and remove the ground from the prescaler output at the edge connector pin 3.

4.7 512 MHz PRESCALER PCB ASSEMBLY A4 (MODELS 6242A and 6244A)

Two 512 MHz Prescalers are in production, they are directly interchangeable and can be replaced with one another without changes to instrument operation and or specifications.

The following description is referenced to Figure 7-15 512 MHz Prescaler PCB Schematic Diagram #7-05706301 and Figure 7-17 512 MHz Prescaler PCB Schematic Diagram #7-06726301, located in chapter 7 of this manual. Circuit description is in respect to Figure 7-15. Minor circuit differences because of different IC's employed, U1, are obvious and therefore only one prescaler is described

The Prescaler PCB Assembly interfaces with the Main Logic PCB Assiembly via a 6-pin connector XA4.

When the B INPUT MHz function is switch selected +5V, -5.2V and -7.2V is applied to the edge connec-

tor pin 6, 5 and 2 respectively to enable the Prescaler. When the A INPUT kHz or MULT Hz function is switch selected the Prescaler is disabled by the removal of the +5V, -5.2V and -7.2V from the edge connector.

The 100 MHz to 512 MHz B INPUT from the front panel BNC connector is applied via in-line fuse F1 (connector J2 provides for the fuse holder which is in series with the input coax cable) and coax cable to coax connector P1. The signal is capacitor coupled by C1, C2 and C3 to the base of Q1. Resistor R1 terminates the input to ground to provide 50Ω input impedance. Diode CR1 and CR2 provides for the front end overload protection.

Transistors Q1 through Q6 configures a broadband low noise high gain amplifier chain. The last transistor in the chain Q6 functions as an emitter follower which is capacitor coupled via C21 and C22 to the divide-by-four counter clock input at U1 pin 4.

U1 is a UHF ECL counter that divides the B INPUT frequency by a factor of 4. The $\overline{Q}$ output U1 pin 3 outputs a ÷ by 4 signal to J3 which provides the prescaled B Input signal to the count gate input on the Main Logic PCB at U4 pin 6.

Diode CR5 and capacitor C27 provides a dc level detector circuit, which outputs a dc level that is proportional to the average amplitude of the signal being applied to the clock input of counter U1. This detected dc level is applied to the inverted input of the differential voltage comparator U2 pin 3. The non-inverted input of the voltage comparator U3 pin 2 is connected to the swinger of potentiometer R18 SENSE adjustment. Potentiometer R18 is adjusted at test to a dc level that is equal to a dc level that relates to a 10 mV rms (-27 dBm) B input signal, thus in effect sets the prescaler threshold (sensitivity). When the dc level at U2 pin 3 is equal to or greater than the level at U3 pin 2 set by potentiometer R18, U3 pin 7 will go low and turn off the Darlington P-N-P transistor Q7 and remove the ground from the prescaler output at the edge connector pin 3.

4.8 BATTERY PACK & CHARGER OPTION 06

When the Battery Pack and Charger is installed as a an option it will automatically implement the battery's dc power when ac line power fails or is removed. During ac line power the battery pack is being charged continually. When the battery pack is fully charged, it will operate the instrument continuously for over three hours.

The Battery Pack and Charger option is installed in the top cover of the instrument and adds 5.6 lbs. (2.5 kg) to the wieght of the instrument. The 06 Option can be installed in the 6241A, 6242A and 6243A Counters when Options 10 or 45 are not installed.

CAUTION

The Battery Pack contains nine 2V 2.5 Amp/Hr lead acid cells. Ensure that the battery pack or individual cells are not subjected to direct shorts. A low resistance shunt or direct short can cause rapid heat build-up and possible explosion.

To avoid dangers associated with recharging batteries, use only Gates #0810-00.04 "D" cells. Do not attempt to use cadmium-zinc, alkaline or like batteries that are not designed to be recharged, or have cell voltages other than 2 volts.

The following discussion of the chargers operation is referenced to Figure 7-26, Battery Pack and Charger Schematic Diagram #7-05772501. The Charger consists of two regulated supplies, one outputting +9V to charge batteries BT6 through BT9 and the other outputting -11V to charge batteries BT1 through BT5. Both charger circuits function in a similar manner, the difference being the polarity and voltage.

The -11V charger circuit is configured from IC Differential Comparator U1, transistors Q2 and Q5 and their associated capacitors, resistors and diodes. The -11V charger output is divided by divider network R23 and R24 to -6.2V and applied to the inverting input of U1 pin 3, and is compared with the -6.2V developed by Zener CR10 which is applied to the non-inverting input of U1 at pin 2. Any differential present on the emitter output of U1 (pin 1) is applied to the base of transistor Q2 via the swinger of potentiometer R3. The emitter of Q2 connects to the base of the series pass regulator Q5 to control the negative charger output voltage and charge current. Potentiometer R3 adjusts the output voltage and potentiometer R4 adjusts the charge rate (current) of the negative charger circuit.

The +9V charger circuit is configured from IC Differential Comparator U2, transistors Q1, Q3 and Q4 and their associated capacitors, resistors and diodes. The +9V charger output is divided by the divider network R14 and R15 to +6.2V and applied to the inverting input of U2 at pin 3, and is compared with the +6.2V developed by Zener diode CR7 which is applied to the non-inverting input of U2 at pin 2. Any differential present on the collector output of U2 (pin 7) is applied to the base of transistor Q1 via transistor Q3 and the swinger of potentiometer R1. The emitter of Q1 outputs to the base of the series pass regulator Q4 to control the positive charger output voltage and charge current. Potentiometer R1 adjusts the output voltage and potentiometer R2 adjusts the charge rate (current) of the positive charger circuit.

The rectifiers and the -5.2V, +5V and -7.2V regulators are located on the Main Logic PCB and interface via a five pin cable and plug (P1) to the top cover mounted Battery Pack and Charger. Bridge rectifier CR3 through CR6 supplies raw -9 and +9 volts to the -5.2V and +5V IC regulators when the instrument is operating on ac line power. Bridge rectifier CR1, CR2, CR7 and CR8 supplies raw -18 volts to the -7.2V IC regulator and the -11 volts charger circuits and raw +18 volts to +9 volts charger circuit when the instrument is operating on ac line power. When the instrument is operating from the battery pack, +8 volts is supplied via diode CR3 to the +5V IC regulator, -8 volts is supplied via diode CR2 to the -5.2V IC regulator and -10 volts is supplied via diode CR1 to the -7.2V IC regulator.

4.9 N COMPUTER AND ACTO PCB ASSEMBLIES A5 and A6 (MODEL 6244A)

The following description is referenced to Figure 4-2, Functional ACTO Logic Diagram and Figures 7-23 and 7-25, the Schematic Diagrams of the N Computer and ACTO PCB's located in Chapter 7 of this manual.

The C input allows for the measurement of signals having a frequency of 0.5 to 4.5 GHz using the ACTO (Automatic Computing Transfer Oscillator) technique.

The signal to be counted is applied to the "N" type C input connector J3 and routed via a semiridged coax cable to the PIN Leveler Assembly. The applied signal is leveled by the level bias control signal generated by the Level Control Circuit located on the A6 Assembly. The PIN Leveler outputs the leveled signal to the Dual Sampler Assembly which is part of the A6 ACTO PCB via a semiridged coax cable.

The Dual Sampler consists of a resistive wide band power splitter which divides and applies the RF input signal equally to the Lock Mixer and the N mixer. The input to the Dual Sampler is sampled and detected by the level detector then applied via pin (5) to the Level Control Circuit comprised of A6U8, A6Q4 and their associated circuit components. A6 U8 is a differential IC amplifier which outputs the difference between the detected RF input level and the voltage set by potentiometer R59 LEVELER ADJ. IC Amplifier A6U8 outputs to transistor A6 Q4 which provides the AGC level bias via a coax cable to the PIN Leveler Assembly.

The PIN diode leveler is a broadband solid state thin film device that functions as both a coupler and a variable attenuator. It consists of a straight through transmission line using PIN diodes in shunt for attenuation control. The impedance of the device is controlled by the bias signal applied to it's coax connector control port. Input RF signals that are within the power range of the Dual Sampler will develop little or no AGC feedback and the PIN diodes appear as a 50Ω load across the transmission line. This constitutes a minimum attenuation condition and allows optimum coupling (minimum insertion loss). As the input RF signal level increases the level bias control signal will increase thereby turning on the PIN diodes and adversely effecting the line impedance. The resulting discontinuity reflects most of the incident power thus increasing the attenuation. The PIN diode Leveler prevents high power RF signals from damaging the Dual Sampler allowing a front panel C input level of up to +20 dBm without damage and an input sensitivity down to −13 dBm.

The RF signal from the dual sampler power divider applied to the Lock Mixer is hetrodyned with the LOCK LO VCO 45-50 MHz output from the collector of A6Q1 via connector pin (8). The Lock IF output from the Lock Mixer is then applied via

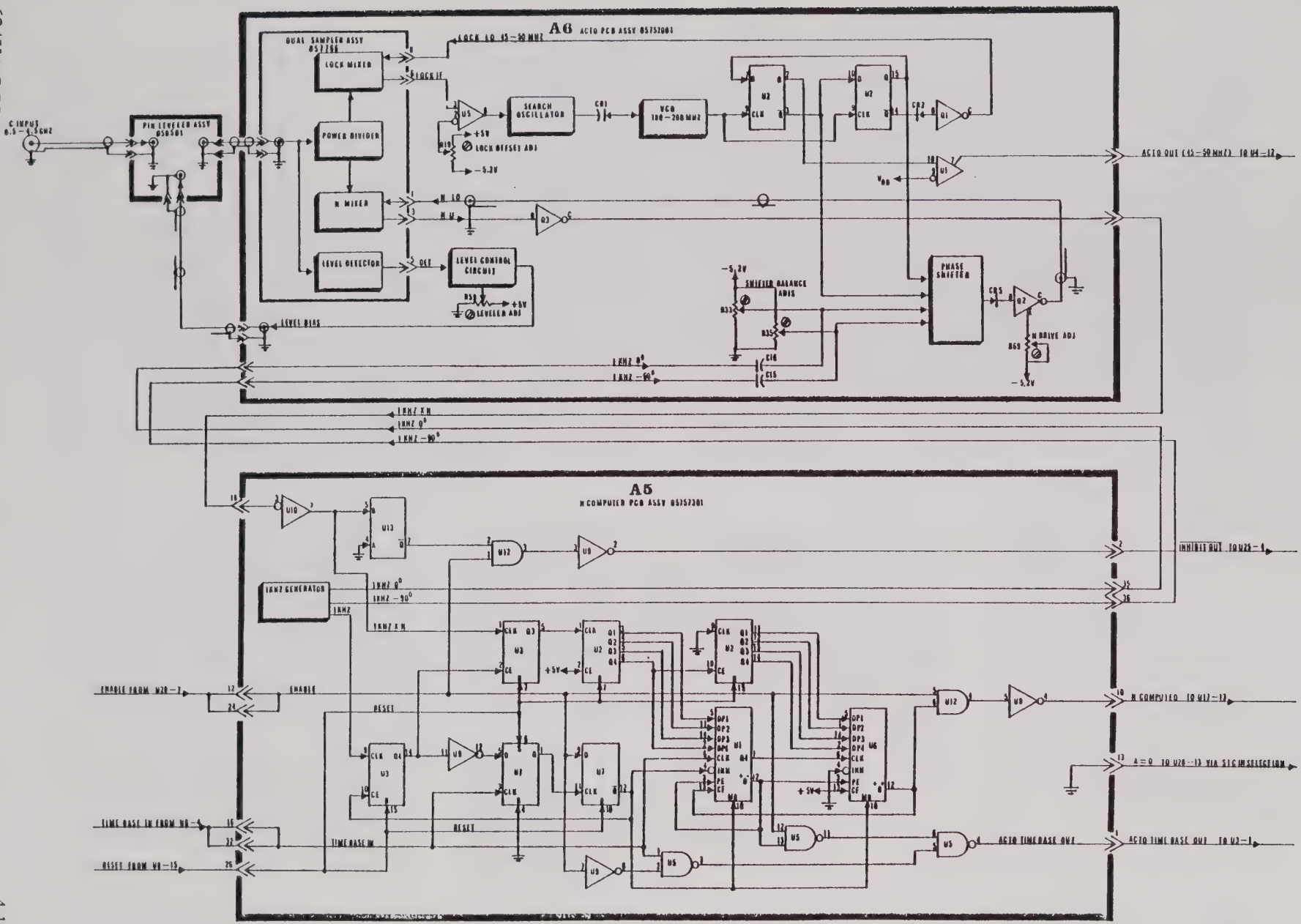


FIGURE 4-2 FUNCTIONAL ACTO LOGIC DIAGRAM

connector pin (6) to the Lock IF Amplifier Discriminator A6U5. Operational Amplifier A6U5 will generate a dc level upon detection of an IF signal that relates to the lock IF frequency. This dc level will take control of the Search Oscillator A6U6 and convert it's function from a ramp generator to a high gain AFC amplifier, thus controlling the VCO and closing up the frequency lock loop (FLL). When the FLL is not locked the Search Oscillator generates a ramp signal which will sweep the VCO from 180 to 200 MHz thus placing the ACTO in it's search mode.

An assumption was made that frequency lock is always obtained on a "true" IF signal that is of sufficient amplitude, which is not always true. In the absence of an input signal or an input signal that is below the ACTO's acquisition level, the Search Oscillator will sweep the VCO over a frequency range wide enough that one or more harmonics are capable of mixing to provide a "false" lock IF signal. When this false lock on condition arises the VCO instead of locking on to the center of the discriminators S curve, will attempt to lock on at the extreme ends of the curve, and be out of range. If this happens, the "false" lock will be lost and discriminator will immediately try to lock on to the same signal thus causing an oscillation. This oscillation will trigger either A6U7 or A6U9 which are fast response differential comparators acting as Schmitt triggers, which will force the Search Oscillator to ignore this unallowable (false) frequency lock on and search for a "true" signal to lock on to.

The VCO is comprised of ECL triple line receiver IC U6A1 and it's associated RCL components. Varicap A6CR1 is the frequency controlling device and is "tuned" by the Search Oscillator output at A6U6 pin 6. The VCO's output at A6U1 pin 2 is applied to the common clock input (pin 9) of the dual type D ECL flip-flop A6U2, which counts down the 180 to 200 MHz VCO output by a factor of four to generate the 45-50 MHz Lock LO outputs. The Lock LO output at A6U2 pin 14 is applied to transistor A6Q1 which provides the drive to the Lock Mixer via connector pin (8), thus providing the path to close the VCO FLL. The Lock LO outputs at A6U2 pins 3 and 15 are applied to the Phase Shifter circuit to allow for the generation of the N LO signal. The Lock LO output at A6U2 pin 2 is applied to pin 10 of A6U1 which supplies the drive for the ACTO output to the counter circuit count gate U4 pin 12 located on the Main Logic PCB.

The Phase Shifter consists of ECL exclusive OR/NOR gates A6U3 and ECL dual differential amplifier A6U4. The Phase Shifter functions as a SSB generator to develop an N LO output for the N Mixer that is 1 kHz higher than the Lock LO 45-50 MHz frequency. The outputs of the VCO at A6U2 pins 2 and 15 are applied to the exclusive OR/NOR gates and gated with the 1 kHz 0° and 1 kHz -90° signals from the 1 kHz Generator located on the A5 PCB Assembly. The exclusive ORing and NORing of the signals cancels out the LOCK LO and the lower 1 kHz sideband, leaving only the upper sideband which provides the 1 kHz shift thus generating a resultant that is the N LO signal. The N LO output at A6U4 pin 14 is applied to transistor driver A6Q2 which provides the drive for the N LO signal to the N Mixer via connector pin (7).

The RF signal from the dual sampler power divider applied to the N Mixer is hetrodyned with the N LO. The output N IF signal of the N Mixer is applied via connector pin (3) to transistor A6Q3 which supplies the drive to the N Computer PCB Assembly A5 as the 1 kHz X N signal.

The N Computer PCB Assembly A5 plugs into the Main Logic PCB Assembly and interfaces via a 36 pin connector with the Main Logic PCB circuits and the ACTO PCB A6 Assembly circuits. Two functional circuits constitute the N Computer the 1 kHz Generator and the ÷N Time Base Counter.

The 1 kHz Generator circuit is comprised of A5U8 and A5U11 configured as a 1 kHz oscillator and outputs two 1 kHz sine waves deplaced 90° in phase to the ACTO PCB Assembly as the 1 kHz 0° and 1 kHz -90° signals. IC A5U4 functions as a Schmitt trigger and digitizes the 1 kHz signal to a CMOS compatible 1 kHz which is applied to the ÷N Time Base Counter circuits.

The 1 kHz X N signal from the ACTO PCB Assembly A6 is applied via A5P1 pin 18 to IC A5U10

which functions as a Schmitt trigger and digitizes the 1 kHz X N signal to a CMOS compatible logic level which is applied to the ÷N counter circuit at A5U3 pin 1 and one shot MV A5U13 pin 5. The ÷N counter is configured by A5U2 a dual binary up counter cascaded as an 8 bit up counter which programs the cascaded 4 bit ÷N counters A5U1 and A5U6. The Time Base clock from the Main Logic (U8 pin 4) supplies a 100 kHz TIME BASE IN signal which is applied to the clock input of the ÷N Counter at A5U1 pin 6. The Q4 output of A5 U1 is fed to the clock input of A5U6 to provide the cascaded 8 bit operation. The "O" state output of A5U6 is feedback to the cascade input (CF) of A5U1 at pin 13. The "O" state output of A5U1 at pin 12 is the ACTO TIME BASE OUT signal which is applied to NAND gate A5U5 pin 13 and the Preset Enables (PE) of A5U1 and A5U6 (pin 3). The dual D type flip-flop A5U7 is clocked by the 100 kHz TIME BASE IN signal and D enabled by the Q4 output of counter A5U3-14. It's $\overline{Q}$ output at A5U7 pin 12 is applied to the MR pin 10 inputs of A5U1 and A5U6 to provide synchronous initiation of the ÷N cycles. The $\overline{Q}$ output of A5U7 at it's pin 12 is gated with the ENABLE signal by A5U12-4 and then inverted by A5U9-4 to generate the "N" COMPUTED signal to flag the Main Logic counter circuits that an ACTO cycle has been completed. The gating configuration of A5U5 enables the "O" state output at A5U1 pin 12 as the ACTO TIME BASE OUT by gating it with the TIME BASE IN, ENABLE and the ÷N cycle reset from A5U7 pin 12 to output it at A5P1 pin 1 to the Main Logic PCB Time Base Count Chain input at U3 pin 1.

CHAPTER 5

MAINTENANCE AND CALIBRATION

5.1 INTRODUCTION

This chapter provides information on the Performance Tests, Preliminary Maintenance and Calibration procedures for the Model 624XA Series Frequency Counters.

5.2 TEST AND CALIBRATION EQUIPMENT

Table 5-1 lists the test equipment required to perform the various procedures for the Model 624XA Series Frequency Counters.

TABLE 5-1

RECOMMENDED TEST EQUIPMENT

Digital Multimeter Systron-Donner Model 7004	ac and dc voltage ±.01% 4 Digit Display
Signal Generator Hewlett Packard Model 651B	10 Hz to 10 MHz +23 dBm (3.16V into 50Ω) output
Signal Generator/Sweeper Wavetek Model 2001	.08 to 1.3 GHz -30 to +20 dBm output
*Signal Generator /Sweeper Micro-Tel Model SG-800	.4 to 5 GHz -13 to +20 dBm output
Oscilloscope Tektronix Model 465	100 MHz at 5 mV/cm Dual-Trace 5 ns/Div sweep rate
Frequency Standard Hewlett Packard Model HP 105 A/B	1 MHz $<1 \times 10^{-10}$ short term stability

* Required for Model 6244A only

5.3 INTERNAL ADJUSTMENT AND TEST POINT LOCATION

Location of all the internal adjustments and test points required to perform the following procedures contained in this chapter are called out in Figures 5-1 through 5-4.

5.4 TIME BASE OSCILLATOR CALIBRATION

The accuracy of measurement is related to the stability of the time base reference oscillator. The calibration period for the reference oscillator is determined by two factors; the required measurement accuracy and the reference oscillators stability and aging rate. Figure 5-5 is a chart that will allow the service technician to determine the required calibration period. To find the required calibration period, lay a straight edge across the chart from the required measurement accuracy to the reference oscillator stability, then read the calibration period off the right hand scale.

Four different reference oscillators may be installed in the counter, which have different aging rates and temperature stability specification. Check the refference oscillator to determine if it is the standard or one of the optional oscillators then check page 1-2 of the manual to find it's stability specifications. It is recommended that the reference oscillator in the counter be calibrated at an ambient temperature of +20°C (+68°F).

To calibrate the reference oscillator use a 1 MHz Frequency Standard with an accuracy of at least 10 times the short term stability of the reference oscillator and an oscilloscope having a sweep rate of 0.01 μs/cm.

1. Apply the 1 MHz output of the Frequency Standard to the external trigger connector of the oscilloscope, set the sweep rate to 0.01 μs/cm and select the external trigger mode.

2. Place the counters rear panel INT/EXT switch in the INT position, and connect the rear panel CLOCK OUT BNC connector to the vertical input of the oscilloscope.

3. Adjust the rear panel OSC. ADJ. control for a near stationary waveform on the oscilloscope, then readjust for minimum drift of the waveform.

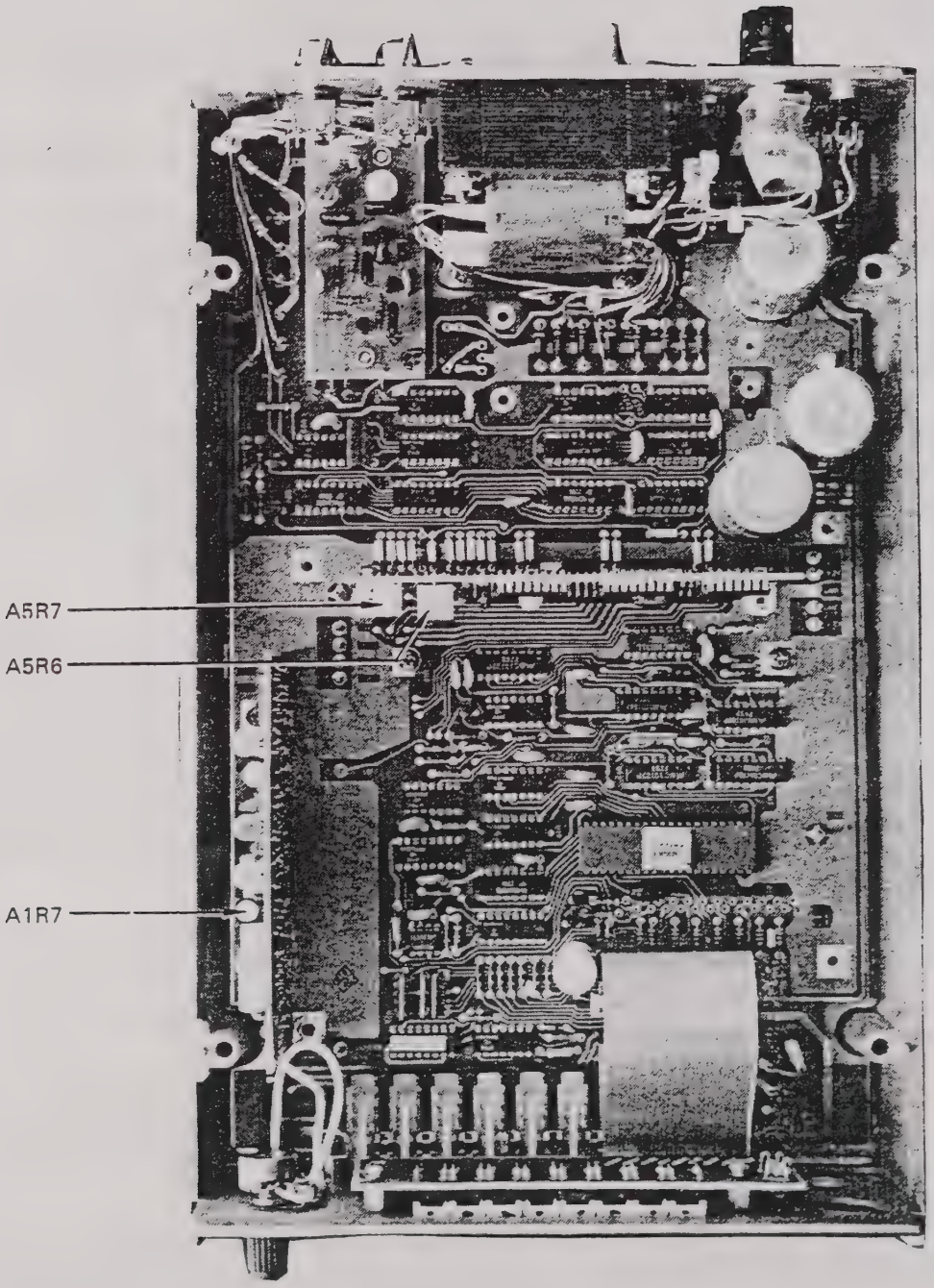


FIGURE 5-1

MODEL 6241A ADJUSTMENTS AND TEST POINT LOCATION DIAGRAM

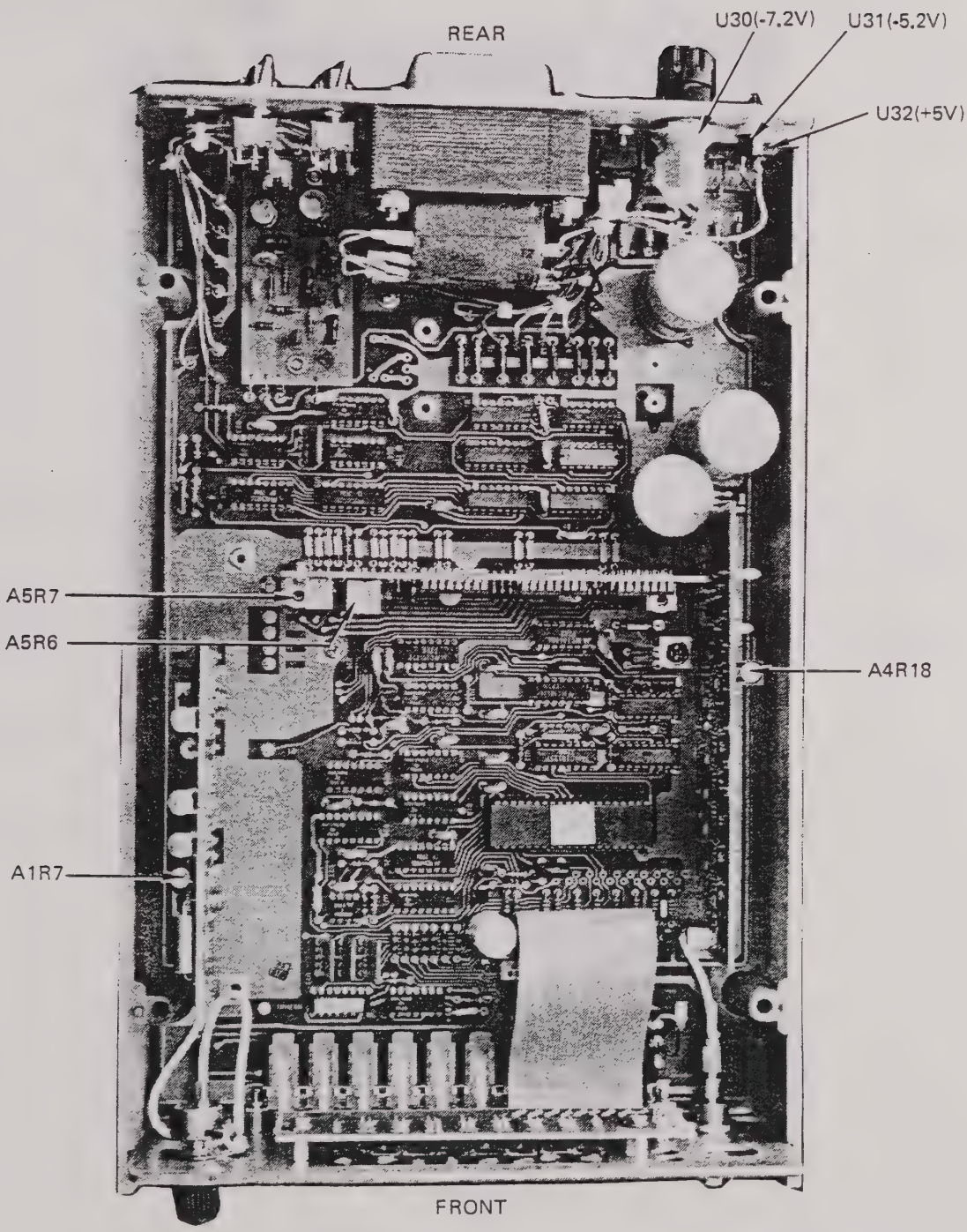


FIGURE 5-2

MODEL 6242A ADJUSTMENTS AND TEST POINT LOCATION DIAGRAM

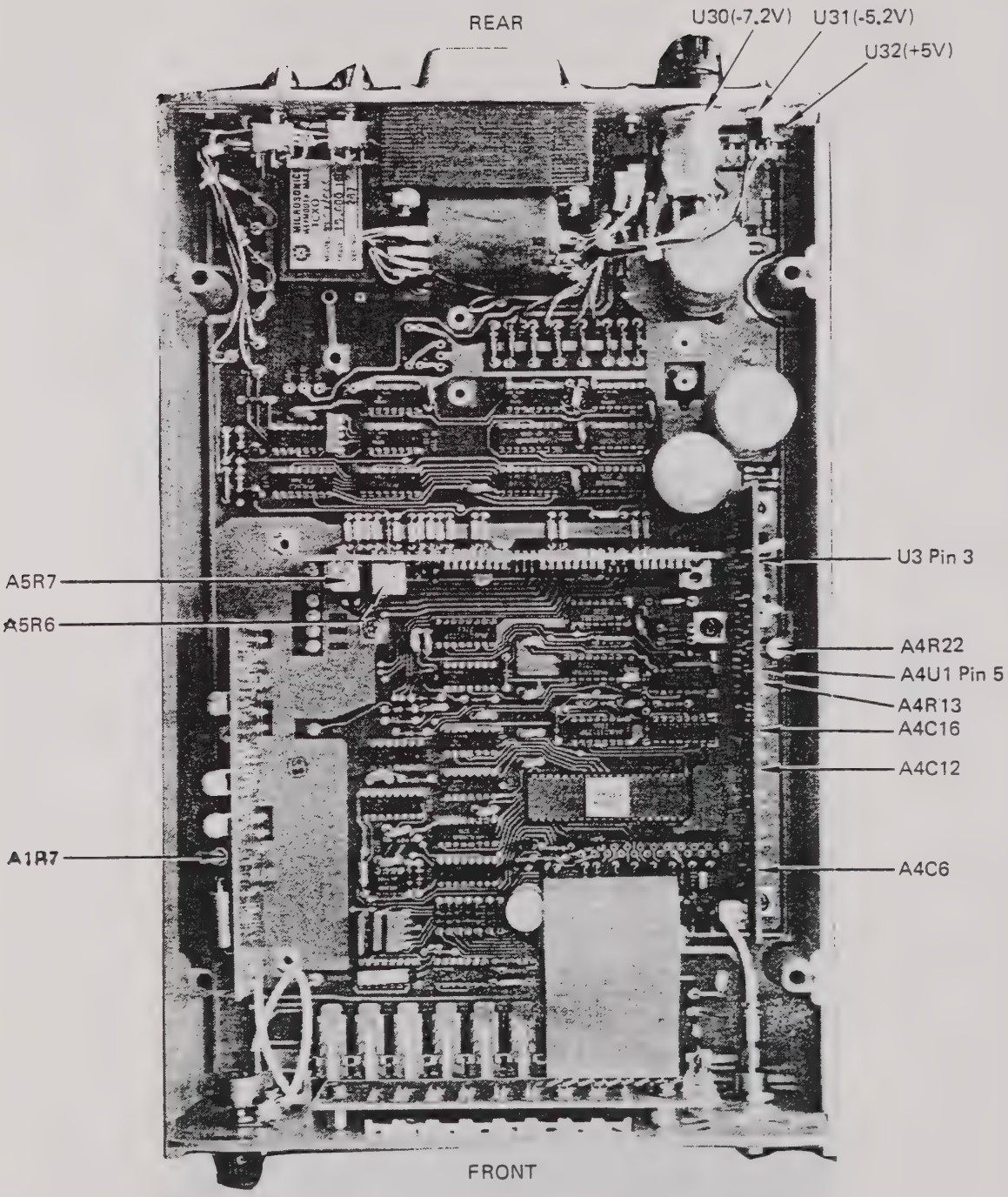


FIGURE 5-3

MODEL 6243A ADJUSTMENTS AND TEST POINT LOCATION DIAGRAM

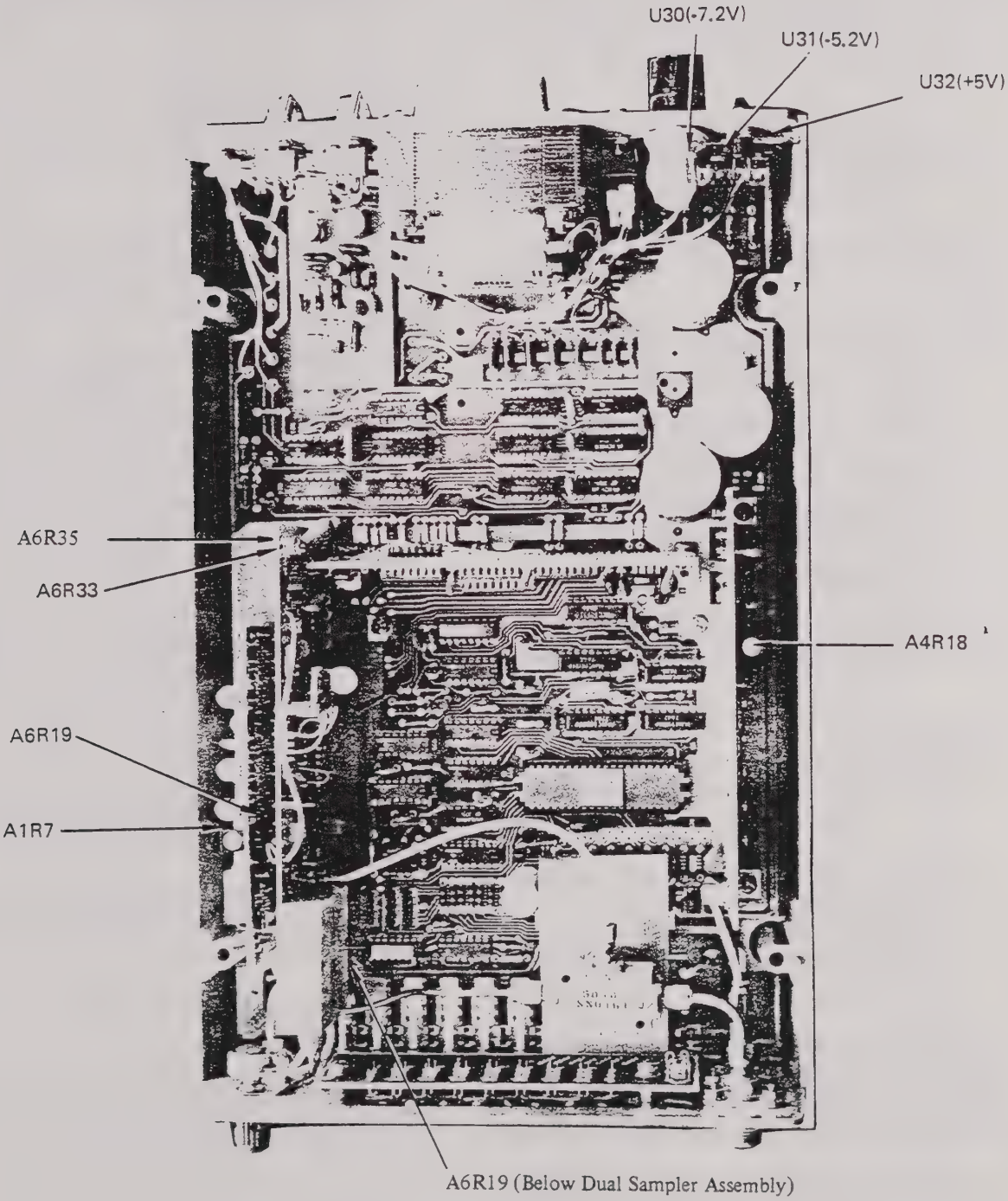


FIGURE 5-4

MODEL 6244A ADJUSTMENTS AND TEST POINT LOCATION DIAGRAM

4. Monitor the oscilloscope noting the rate of drift. The amount of error as referenced to the Frequency Standard can be calculated by the drift rate. A 1 cm/s drift indicates an error of 1 part in 10^{-8} (0.01 PPM).

5.5 CHECKOUT PROCEDURE AND INITIAL LOGIC PCB CONFIDANCE TEST (ALL MODELS)

1. Insure that the Power Transformer T1 primary is wired for 115 Vac operation and that a .25A SLO-BLO fuse is installed in the rear panel fuse holder F1.

2. Insure that the ac N and H inputs are isolated from the chassis (resistance check).

3. Insure that the ac ground input is connected to the chassis (resistance check).

4. Insure that the +5V, -5.2V, -7V and the +15V (Option 10) buses are not grounded or connected together (resistance check).

5. Apply 115 Vac power to rear panel 115V connector and press POWER push button switch.

6. Measure and verify the following voltage regulator outputs.

U31	-5.2V ±.25V (-4.95 to -5.45V)
U32	+5V ±.25V (+4.75 to +5.25V)
U30	-7.2V + .35V - .2V (-7.0 to -7.55V)

7. Place the rear panel RUN HOLD toggel switch in it's RUN position.

8. Place the rear panel INT EXT toggel switch in it's INT position.

9. Select A IN kHz FUNCTION and 1 kHz RESOLUTION, press the rear panel LAMP TEST push button switch and verify that the display indicates 88888888. and the GATE indicator LED flashes.

10. Perform the following display readout check by selecting the different FUNCTION and RESOLUTION push button switch selections.

SELECT		DISPLAY
FUNCTION	RESOLUTION	READOUT
A IN 1 kHz	1 kHz	0.
A IN 1 kHz	100 Hz	0.0
A IN 1 kHz	10 Hz	0.00
A IN 1 kHz	1 Hz	0.000
A IN 1 kHz	.1 Hz	0.0000
B IN 1 MHz	1 kHz	0.0000000
B IN 1 MHz	100 Hz	0.000000
B IN 1 MHz	10 Hz	0.00000
B IN 1 MHz	1 Hz	0.0000
B IN 1 MHz	.1 Hz	0.000
MULT Hz	.1 Hz	0.000
MULT Hz	1 Hz	0.00
MULT Hz	10 Hz	0.0

11. Place the rear panel INT EXT toggel switch to it's EXT position. Apply a 1 MHz 1 Vrms clock to the rear panel CLOCK IN BNC connector. Select A IN kHz FUNCTION and 1 kHz RESOLUTION verify a display readout of 0. and note that the GATE LED indicator flashes. Return the INT EXT toggel switch to it's INT position.

12. Place the rear panel RUN HOLD toggel switch to it's HOLD position, and verify that the GATE LED indicator extinguishes. Return the RUN HOLD toggel switch to it's RUN position.

13. Press and hold the RESET pushbutton switch and verify that the GATE LED indicator extinguishes, release the RESET pushbutton switch and verify that the GATE LED resumes flashing.

5.6 AMPLIFIER PCB ASSEMBLY A1 PERFORMANCE TEST AND ADJUSTMENT PROCEDURE (ALL MODELS)

1. Select A IN kHz FUNCTION and 1 kHz RESOLUTION.

2. Apply a 100 MHz -27 dBm (10 mVrms) signal to the A INPUT 20 Hz -100 MHz BNC connector, terminated at 50 ohms, set the A INPUT SENSITIVITY control to it's MAX position.

3. Adjust potentiometer A1R7 for a 1 MHz display indication (1000).

4. Slowly decrease the level of the applied 1 MHz signal while adjusting potentiometer A1R7 for maximum sensitivity.

5. Check the operation of the A IN counter function from 20 Hz to 100 MHz at applied signal levels of 10 mVrms to it's overload without damage levels.

NOTE

Do not exceed an input level of 250 Vrms below 10 kHz, 50 Vrms from 10 kHz to 2 MHz and 5 Vrms from 2 MHz to 100 MHz.

5.7 512 MHz PRESCALER PCB ASSEMBLY A4 PERFORMANCE TEST AND ADJUSTMENT PROCEDURE (MODELS 6242A AND 6244A)

1. Select B IN MHz FUNCTION and 1 kHz RESOLUTION.

2. Configure an oscilloscope and a sweep generator as follows:

Oscilloscope Vertical Sensitivity at 100 mv/Div. Connect oscilloscope vertical input to A4U2 pin 3 on the 512 MHz Prescaler. Apply an 80 to 520 MHz sweep signal at a -33 dBm level to the B INPUT 100-512 MHz BNC connector.

3. Observe the oscilloscope and note the least sensitive voltage level (least negative voltage).

4. Manually adjust to frequency of the applied signal form 80 to 520 MHz and note the frequency that provides least sensitivity.

5. Apply the least sensitive frequency noted in step 5 at a level of -30 dBm and adjust potentiometer A4R18 for a proper counter display at a -30 dBm input signal level. Decrease the apply signal 1 dB and verify that the counter stops counting, readjust potentiometer A4R18 as required.

6. Apply an 80 to 512 MHz sweep frequency signal, while varying it's level from -30 dBm to +20 dBm and verify proper counter operation for all frequencies and input levels.

NOTE

If +27 dBm (5 Vrms) input signal level is exceeded a .275 A fuse located within the B INPUT connector will blow. Available as Option 057245, five spare input fuses are furnished with each counter.

5.8 1.25 GHz PRESCALER PCB ASSEMBLY A4 PERFORMANCE TEST AND ADJUSTMENT PROCEDURE (MODEL 6243A ONLY)

1. Select B IN MHz FUNCTION and 1 kHz RESOLUTION.

2. Configure an oscilloscope and a sweep generator as follows;

Oscilloscope Vertical Sensitivity at 100 mV/Div. Connect Oscilloscope vertical input to A4U3 pin 3.
Apply a .9 to 1.3 GHz sweep generator signal at a -30 dBm level to the B INPUT 100 - 1250 MHz BNC connector.

3. Adjust trimmer capacitors A4C6 and A4C16 for minimum variation of the signal amplitude at A4U3 pin as boserved on the oscilloscope (best flatness of response from .9 to 1.25 MHz).

4. Apply a 1.26 MHz -30 dBm signal to the B IN BNC connector. Rotate potentiometer A4R13 V_{CC} ADJ fully CW. Rotate potentiometer A4R22 SENS fully CCW.

5. Temperature stabilize IC A4U1 with a Heat Probe or a Heat Gun to 50°C. Adjust potentiometer A4R13 CCW while decreasing the level of the applied 1.26 GHz to obtain maximum sensitivity (≤-33 dBm).

6. Measure and record the voltage at ICA4U1 pin 5 with a DVM. Adjust potentiometer A4R13 CW for an increase of -200 mV over the previous record DVM measurement at A4U1 pin 5.

7. Apply an .08 to 1.26 GHz sweep frequency at a level of -33 dBm to the B IN BNC connector. Observe the level on A4U3 pin 3 on the oscilloscope and note and record the least negative voltage. With the sweep generator in it's manual sweep mode apply

a frequency that produces least negative voltage at A4U3 pin 3 that was recorded above. Insure that A4U1 is temperature stabilized at 50°C. Adjust potentiometer A4R22 SENS for a proper display readout of the frequency at -30 dBm.

8. Apply an .08 to 1.26 GHz sweep frequency signal while varying it's level from -30 dBm to +20 dBm and verify proper counter operation for all frequencies and input levels.

NOTE

If +27 dBm (5 Vrms) input signal level is exceeded a .275 A fuse located within the B INPUT connector will blow. Five spare input fuses are furnished with each counter reference part number SD057245.

5.9 MULTIPLIER PCB ASSEMBLY A5 PERFORMANCE TEST AND ADJUSTMENT PROCEDURE (OPTION 45 MODELS 6241A, 6242A and 6243A)

1. Select MULT Hz FUNCTION and 10 Hz RESOLUTION.

2. Apply a 40.2 Hz at a -20 dBm level to the A INPUT BNC connector, terminated at 50 ohms.

3. Adjust potentiometer A5R7 (MIN) for a display readout of 40.2 and a flashing display when the applied signal frequency is decreased to 40.0 Hz.

4. Increase the applied signal frequency to 3.25 kHz and adjust potentiometer A5R6 (MAX) until the display flashes.

5. Check the operation of the Multiplier function from 50 Hz to 3 kHz at a -30 dBm input level signal. Verify that any counter readout jitter is $\leq \pm 3$ counts.

5.10 BATTERY PACK AND CHARGER OPTION 06 ADJUSTMENT PROCEDURE

CAUTION

The Battery Pack contains nine 2 volt 2.5 Amp/Hr lead acid cells. Insure that the battery pack or individual cells are not subjected to direct shorts. A low resistance shunt or direct short can cause rapid heat build-up and possible explosion.

To avoid dangers associated with recharging batteries, use only Gates #0810-00-04 "D" cells. Do not attempt to use cadmium-zinc, alkaline or like batteries that are not designed to be recharged, or have cell voltages other than 2 volts.

To adjust the charger output voltages and charge rates, perform the following steps:

1. Remove top cover from the instrument and place it alongside the bottom cover assembly with the interconnecting cable plug attached.

2. Remove the black ground wire clips from the + terminal of battery BT5 and the – terminal of battery BT6.

3. Insure that the front panel POWER (red) pushbutton switch is off (in it's out position), and connect the counters line cord to an ac line source.

4. Jumper test point "A" (orange) to test point "GND" (black).

5. Connect a DVM across the two brown test points (TP1) and adjust potentiometer R1 for a 6.75 volt reading on the DVM.

6. Remove the jumper between the orange and black test points (that was jumpered instep 4), and jumper test point "A" (orange) to test point "B" (yellow).

7. Adjust potentiometer R2 for a DVM reading of 0.400 volts at the brown test points (TP1).

8. Remove the jumper between the orange and yellow test points (that was jumpered in step 6), and jumper point "C" (blue) to test point "GND" (black).

9. Connect the DVM across the two red test points (TP2) and adjust potentiometer R3 for a 6.75 volt reading on the DVM.

10. Remove the jumper between the blue and black test points (that was jumpered in step 8) and jumper test point "C" (blue) to test point "B" (yellow).

11. Adjust potentiometer R4 for a 0.400 volt reading on the DVM.

12. Remove the jumper between the blue and yellow test points (installed in step 10), disconnect the DVM from the red test points (TP2), remove the line cord from the power source, and reconnect the black ground wire clips to the + terminal of battery BT5 and the – terminal of battery BT6 (which was disconnected in step 1).

13. Reinstall the top cover on the counter, reconnect the line cord to the ac source, press the front panel POWER switch and insure that it latches in it's on position (in). Check the counter for proper operation, then disconnect the line cord from the ac source and verify that the counter operates from it's battery pack.

5.11 ACTO PCB ASSEMBLY A6 AND N COMPUTER PCB ASSEMBLY A5 PERFORMANCE TEST AND ADJUSTMENT PROCEDURE (MODEL 6244A ONLY)

1. Select C IN MHz FUNCTION.

2. Preset the following potentiometer adjustments as follows;

A6R59 LEVELER ADJUST fully CCW
A6R69 N DRIVE 1/4 CW
A6R33 SHIFTER BALANCE mid range
A6R35 SHIFTER BALANCE mid range

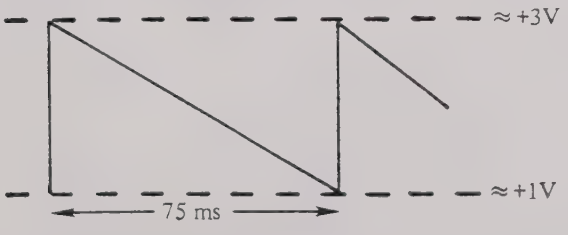
3. Disconnect coax cable on PCB Assembly A6 going to the PIN Leveler Assembly 050501.

4. Remove Lock Logic PC Assembly 0591101 from the ACTO PCB Assembly A6.

5. Connect an Oscilloscope to test point A6TP3 and set up Oscilloscope as follows;

1V/Div, DC, Internal trigger on signal -AC, NORM, +.

6. Adjust A6R19 LOCK OFFSET potentiometer while monitoring A6TP3 to obtain a 75 ms ramp.



7. Apply a 500 MHz signal to the front panel C INPUT connector and increase it's level until the ramp locks. Verify that the ramp locks on at ≈-18 dBm applied signal level.

8. Monitor the 1 kHz X N signal with the Oscilloscope, (Vertical to A5TP2, 50 mV/div, AC, Trigger to A5TP1); and adjust A6R69 N DRIVE, A6R33 and A6R35 SHIFTER BALANCE to obtain a symmetrical modulated signal of ⩾100 mV peak-to-peak, while locked on to input signals of 4.5 GHz at -16 dBm and 500 MHz at -18 dBm being applied to the C INPUT connector.

NOTE

Adjust R69 least amount CCW to get good signal.

9. Reconnect the coax cable going to the PIN Leveler Assembly, that was disconnected in step 3.

10. Apply 4.5 GHz at -10 dBm to the C INPUT connector and note the peak-to-peak amplitude of the 1 kHz X N signal A5TP2 (Vertical to A5TP2, 50 mV/div, AC, Trigger to A5TP1). Then rotate A6R59 LEVELER ADJUST CW until the 1 kHz X N signal is decreased by 50 mV peak-to-peak.

11. Reinstall the Lock Logic PC Assembly that was removed in step 4.

12. Connect the oscilloscope to test point A6TP3 to monitor the ramp wave form as in step 5. Apply a 500 MHz -10 dBm signal and verify the ramp locks on, then *slowly* increase the frequency of the applied signal and verify that the ramp's amplitude does not exceed ≈4.5V (at ≈4.5V of ramp amplitude, A6U9 pin 7 will go high and force the ramp to a lower voltage lock point.)

13. Check sensitivity and proper ACTO operation from 450 MHz to 4.5 GHz at -16 dBm to +20 dBm. At the higher input levels (⩾+1 dBm), momentarily ground A6TP2 (to break lock) and verify correct ramp timing and amplitude.

NOTE

Sensitivity at 4.5 GHz should be between -16 dBm and -20 dBm. Ramp timing will effect sensitivity and may be adjusted to correct for high or low sensitivity. Do not adjust ramp timing for a period that is greater than 125 ms.

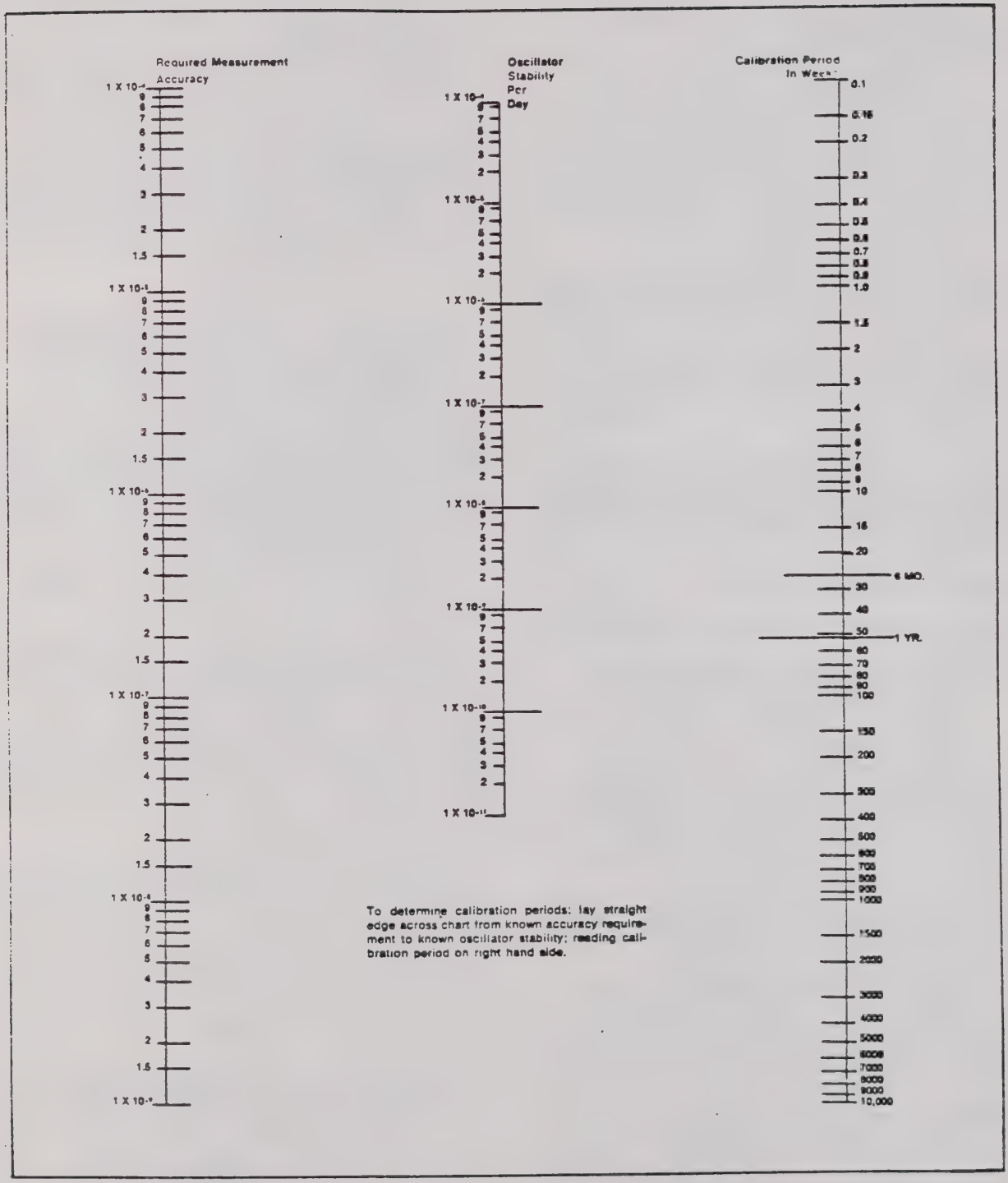

Required Measurement Accuracy
Oscillator Stability Per Day
Calibration Period In Weeks
6 MO.
1 YR.
To determine calibration periods: lay straight edge across chart from known accuracy requirement to known oscillator stability; reading calibration period on right hand side.

FIGURE 5-5 REFERENCE OSCILLATOR CALIBRATION PERIODS

5.12 INTEGRATED CIRCUITS COMPONENT DATA

The major IC components in the 624XA series Frequency Counters are described in this section to aid in circuit description, troubleshooting and repair of the unit. Components are not described in complete detail but are extracts from the manufacturer's specification catalog. For those IC's not described or if more significant characteristics is required refer to the appropriate manufacturers specification sheet and/or catalog. Table 5.2 lists the IC's in alphanumeric manufacturer's part number order.

TABLE 5.2 I.C. COMPONENT DESCRIPTION

COMPONENT NUMBER	TITLE	S-D PART NUMBER	PAGE
CA3130T	Linear Operational Amplifier	103231	5-12
CD4049E	CMOS Hex Inverter/Buffer	103217	5-13
LM201AH	Linear Operational Amplifier	025758	5-13
MC10100P	ECL Quad 2-Input NOR Gate	103712	5-14
MC10107P	ECL Triple Exclusive OR/NOR Gate	103179	5-14
MC10124L	ECL Quad TTL/ECL Translator	045228	5-15
MC10125L	ECL Quad ECL/TTL Translator	045226	5-15
MC10131L	ECL Dual D M-S Flip-Flop	045239	5-16
MC10138P	ECL MSI Bi-Quinary Counter	103837	5-17
MC10216L	ECL Triple Line Driver	045276	5-18
MC10231L	ECL High Speed D M-S Flip-Flop	045227	5-19
MC14011P	CMOS Quad 2-Input NAND Gate	103937	5-20
MC14013P	CMOS Dual D Flip-Flop	103199	5-20
MC14046P	CMOS Phase Locked Loop	103939	5-21
MC14049CP	CMOS Hex Inverter/Buffer	103217	5-22
MC14050CP	CMOS Hex Inverter/Buffer	103492	5-22
MC14081BCP	CMOS Quad 2-Input And Gate	116101	5-23
MC14508BCP	CMOS Dual 4-Bit Latch	117257	5-23
MC14512CP	CMOS 8-Channel Data Selector	103942	5-24
MC14518CP	CMOS Dual BCD Up Counter	103339	5-25
MC14520CP	CMOS Dual Binary Up Counter	117278	5-25
MC14526BCP	CMOS Programmable ÷ N Counter	117144	5-27
MC14528CP	CMOS Dual One-Shot MV	103433	5-28
MC1697P	1 GHz Decade Counter	103872	5-29
MC7805CP	+5V Voltage Regulator	045256	5-30
MC7815CP	+15V Voltage Regulator	103039	5-30
MC7902CP	-2V Voltage Regulator	103944	5-31
MC79L05ACP	-4.8 to -5.2 Low Power Voltage Regulator	117014	5-31
MC7905.2CP	-5.2V Voltage Regulator	103033	5-31
NE555V	Linear Timer	045208	5-32
SD055095	CMOS LSI Count Chain/Multiplexer	055095	5-33
SD055998	TTL Prom (74188A) Decimal And Measurement Unit	055998	5-36
SN72311P	Linear Differential Voltage Comparator	103942	5-38
SN74LS00N	TTL Low Power Schottkly Dual 2-Input NAND Gate	103130	5-38
SN74LS08	TTL Low Power Schottkly Quad 2-Input AND Gate	103967	5-39
SN74L32N	TTL Low Power 2-Input Quad NOR Gate	103972	5-39
SN7490N	TTL MSI Decade Counter	025732	5-40
SN74LS123	TTL Low Power Schottkly Dual One-Shot MV	103976	5-41
SN74LS196N	TTL MSI Low Power Schottkly Decade Counter/Latch	103164	5-42
SN74LS197	TTL Low Power Schottkly Binary Counter/Latch	103165	5-44
SN74247N	TTL MSI Seven Segment Decoder/Driver	103314	5-45

CA3130T

S-D P/N 103231

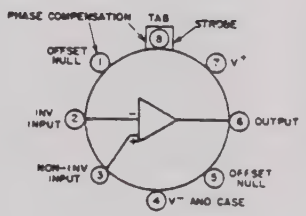
RCA-CA3130T, CA3130S, CA3130AT, CA3130AS, CA-31308T, and CA3130BS are integrated-circuit operational amplifiers that combine the advantages of both COS/MOS and bipolar transistors on a monolithic chip.

Gate-protected p-channel MOS/FET (PMOS) transistors are used in the input circuit to provide very-high-input impedance, very-low-input current, and exceptional speed performance. The use of PMOS field-effect transistors in the input stage results in common-mode input-voltage capability down to 0.5 volt below the negative-supply terminal, an important attribute in single-supply applications.

A complementary-symmetry MOS (COS/MOS) transistor pair, capable of swinging the output voltage to within millivolts of either supply-voltage terminal (at very high values of load impedance), is employed as the output circuit.

The CA3130 Series circuits operate at supply voltages ranging from 5 to 16 volts, or ±2.5 to ±8 volts when using split supplies. They can be phase compensated with a single external capacitor, and have terminals for adjustment of offset voltage for applications requiring offset-null capability. Terminal provisions are also made to permit strobing of the output stage.

The CA3130 Series is supplied in either the standard 8-lead TO-5-style package (T suffix) or in the 8-lead dual-in-line formed-lead TO-5-style package "DIL-CAN" (S suffix) and operates over the full military temperature range of -55°C to +125°C. The CA3130B is intended for applications requiring premium-grade specifications and with limits established for input current, temperature coefficient of input offset voltage, and gain over the range of −55°C to +125°C. The CA3130A offers superior input characteristics over those of the CA3130



MAXIMUM RATINGS, *Absolute-Maximum Values*

DC SUPPLY VOLTAGE
(BETWEEN V+ AND V− TERMINALS) ..... 16 V
DIFFERENTIAL-MODE INPUT VOLTAGE ..... ±8 V
COMMON-MODE DC INPUT VOLTAGE ..... V+ to (V− -0.5 V)
INPUT-TERMINAL CURRENT ..... 1 mA
DEVICE DISSIPATION
WITHOUT HEAT SINK−
UP TO 55°C ..... 630 mW
ABOVE 55°C ..... Derate linearly 6.67 mW/°C
WITH HEAT SINK−
AT 125°C ..... 418 mW
BELOW 125°C ..... Increase linearly at 16.7 mW/°C
TEMPERATURE RANGE:
OPERATING ..... −55 to +125°C
STORAGE ..... −65 to +150°C
OUTPUT SHORT-CIRCUIT DURATION* ..... INDEFINITE
LEAD TEMPERATURE (DURING SOLDERING)
AT DISTANCE 1/16 ± 1/32 INCH (1.59 ± 0.79 MM)
FROM CASE FOR 10 SECONDS MAX. ..... +265°C

*Short circuit may be applied to ground or to either supply

CMOS HEX INVERTER/BUFFER

CD4049E

S-D P/N 103217

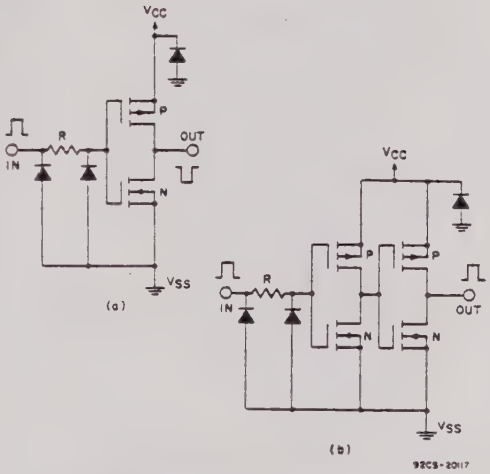
The CD4049A and CD4050A are inverting and non-inverting hex buffers, respectively, and feature logic-level conversion using only one supply voltage (V_{CC}). The input-signal high level (V_{IH}) can exceed the V_{CC} supply voltage when these devices are used for logic-level conversions. These devices are intended for use as COS/MOS to DTL/TTL converters and can drive directly two DTL/TTL loads. (V_{CC} = 5 V, $V_{OL} \leq 0.4$ V, and $I_{ON} \geq 3$ mA.)

Table 1 shows the range of voltage-supply levels that can be utilized for such logic level conversions. Conversion to logic-levels greater than +6 V is permitted provided that $V_{CC} \leq V_{IH}$.

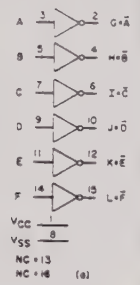
The CD4049A and CD4050A are designated as replacements for CD4009A and CD4010A, respectively. Because the CD4049A and CD4050A require only one power supply, they are preferred over the CD4009A and CD4010A and should be used in place of the CD4009A and CD4010A in all inverter, current driver, or logic-level conversion applications. In these applications the CD4049A and CD4050A are pin compatible with the CD4009A and CD4010A respectively, and can be substituted for these devices in existing as well as in new designs. Terminal No. 16 is not connected internally on the CD4049A or CD4050A, therefore, connection to this terminal is of no consequence to circuit operation.

The CD4049A and CD4050A are supplied in 16-lead dual in-line ceramic packages (CD4049AD and CD4050AD), 16 lead dual-in-line plastic packages (CD4049AE and CD4050AE; and 16-lead flat packages (CD4049AK and CD4050AK).

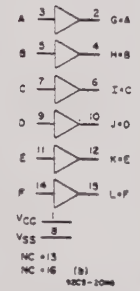
FUNCTION	COS/MOS VOLTAGE RANGE (INPUT)	DTL/TTL VOLTAGE RANGE (OUTPUT)	POWER SUPPLY VOLTAGE RANGE (V_{CC})
HEX LEVEL SHIFTER	3–15 V	3–6 V	3–6 V
HEX INVERTER HEX BUFFER	3–15 V	3–15 V	3–15 V



a) Schematic diagram of CD4049A, 1 of 6 identical units;
b) Schematic diagram of CD4050A, 1 of 6 identical units.



CD4049A

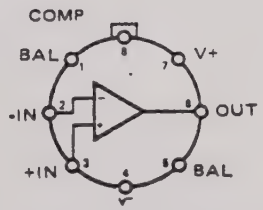


CD4050A

LINEAR OPERATIONAL AMPLIFIER

LM201AH

S-D P/N 025758



The LM201AH is a general purpose operational amplifier packaged in an 8-lead TO -5 case.

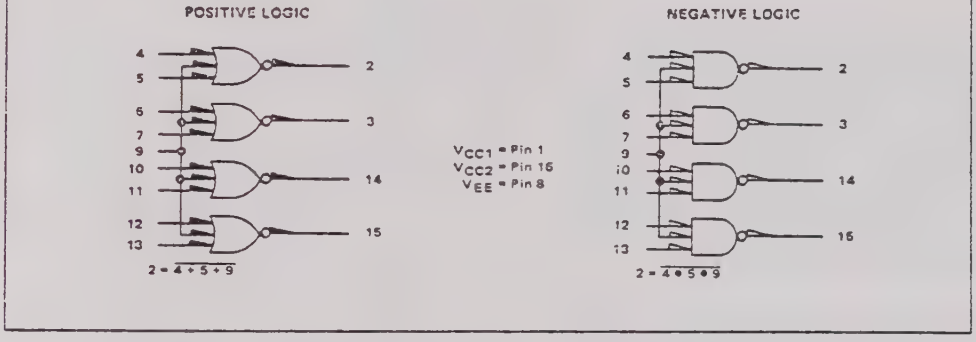
ECL QUAD 2-INPUT NOR GATE

MC10100P

S-D P/N 103712

The MC10100 is a quad NOR gate. Each gate has 3 inputs, two of which are independent and one of which is tied common to all four gates. Input pull-down resistors eliminate the need to tie unused inputs to a voltage supply. Open emitter outputs permit wire-ORing and direct connection to buses.

P_D = 25 mW typ/gate (No Load)
t_{pd} = 2.0 ns typ

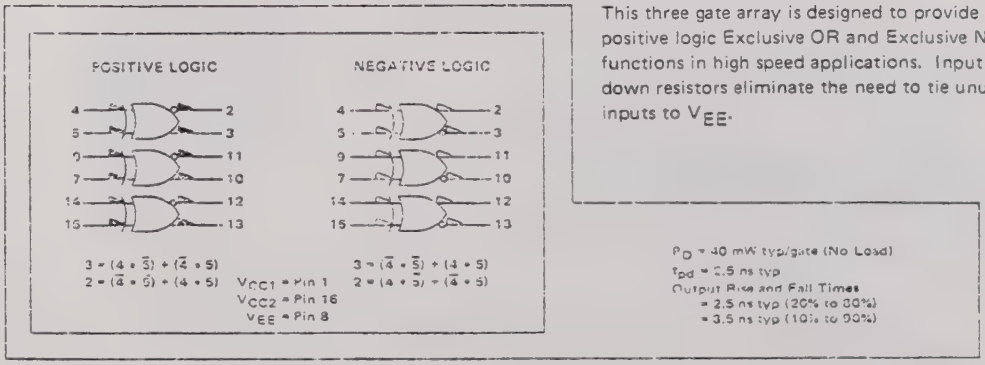


ECL TRIPLE EXCLUSIVE OR/NOR GATE

MC10107P

S-D P/N 103179

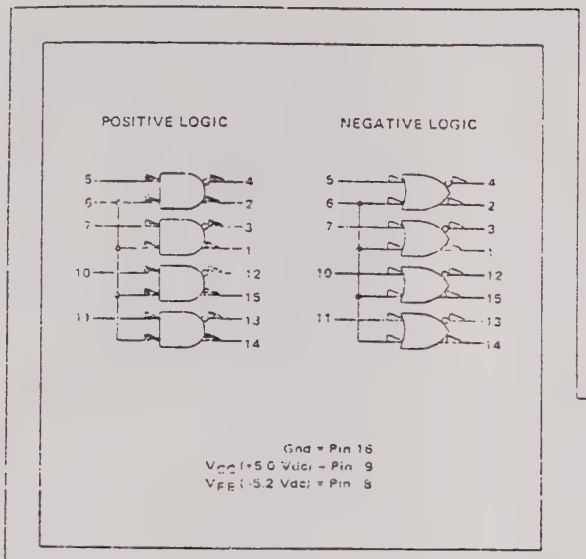
This three gate array is designed to provide the positive logic Exclusive OR and Exclusive NOR functions in high speed applications. Input pull-down resistors eliminate the need to tie unused inputs to V_{EE}.



P_D = 40 mW typ/gate (No Load)
t_{pd} = 2.5 ns typ
Output Rise and Fall Times
= 2.5 ns typ (20% to 80%)
= 3.5 ns typ (10% to 90%)

ECL QUAD TTL/ECL TRANSLATOR

MC10124L **S-D P/N 045228**



The MC10124 is a quad translator for interfacing data and control signals between a saturated logic section and the MECL section of digital systems. The MC10124 has MTTL compatible inputs, and MECL complementary open-emitter outputs that allow use as an inverting/non-inverting translator or as a differential line driver. When the common strobe input is at the low logic level, it forces all true outputs to a MECL low logic state and all inverting outputs to a MECL high logic state.

Power supply requirements are ground, +5.0 Volts, and -5.2 Volts. Propagation delay of the MC10124 is typically 3.5 ns. The dc levels are standard or Schottky TTL in, MECL 10,000 out.

An advantage of this device is that MTTL level information can be transmitted differentially, via balanced twisted pair lines, to the MECL equipment, where the signal can be received by the MC10115 or MC10116 differential line receivers. The MC10124 is useful in computers, instrumentation, peripheral controllers, test equipment, and digital communications systems.

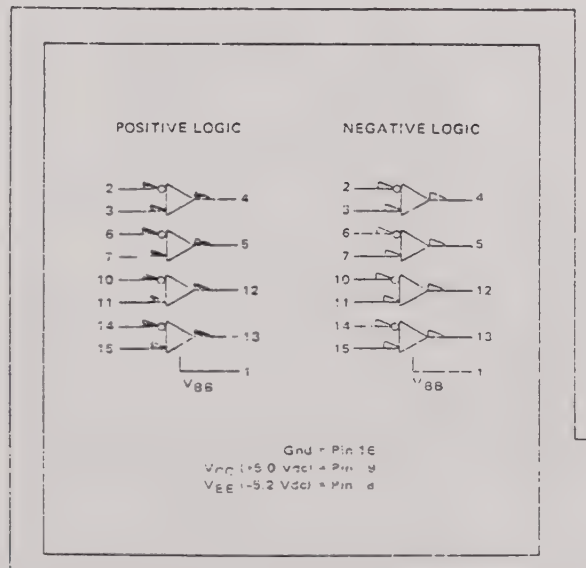
P_D = 380 mW typ/pkg (No Load)

t_{pd} = 3.5 ns typ (+1.5 Vdc in to 50% out)

Output Rise, Fall Times,
2.5 ns typ (20% to 80%)

ECL QUAD ECL/TTL TRANSLATOR

MC10125L **S-D P/N 045226**



The MC10125 is a quad translator for interfacing data and control signals between the MECL section and saturated logic sections of digital systems. The MC10125 incorporates differential inputs and Schottky MTTL "totem pole" outputs. Differential inputs allow for use as an inverting/non-inverting translator or as a differential line receiver. The V_{BB} reference voltage is available on pin 1 for use in single-ended input biasing. The outputs of the MC10125 go to a low logic level whenever the inputs are left floating.

Power supply requirements are ground, +5.0 Volts and -5.2 Volts. Propagation delay of the MC10125 is typically 4.5 ns. The MC10125 has fanout of 10 MTTL loads. The dc levels are MECL 10,000 in and Schottky TTL, or MTTL out. This device has an input common mode noise rejection of ±1.0 Volt.

An advantage of this device is that MECL level information can be received via balanced twisted pair lines, in the MTTL equipment. This isolates the MECL logic from the noisy MTTL environment. This device is useful in computers, instrumentation, peripheral controllers, test equipment and digital communications systems.

P_D = 380 mW typ/pkg (No Load)

t_{pd} = 4.5 ns typ (50% to +1.5 Vdc out)

Output Rise, Fall Times,
2.5 ns typ (20% to 80%)

V_{CCmax} = +7.00 Vdc

R-S TRUTH TABLE

R	S	Q_{n+1}
L	L	Q_n
L	H	H
H	L	L
H	H	N.D.

N. D. = Not Defined

CLOCKED TRUTH TABLE

C	D	Q_{n+1}
L	ø	Q_n
H	L	L
H	H	H

ø = Don't Care

$C = \overline{C}_E + C_C$

A clock H is a clock transition from a low to a high state

The MC10131 is a dual master-slave type D flip-flop. Asynchronous Set (S) and Reset (R) override Clock (C_C) and Clock Enable ($\overline{C}_E$) inputs. Each flip-flop may be clocked separately by holding the common clock in the low state and using the enable inputs for the clocking function. If the common clock is to be used to clock the flip-flop, the Clock Enable inputs must be in the low state. In this case, the enable inputs perform the function of controlling the common clock.

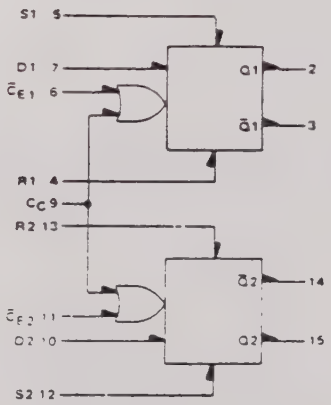
The output states of the flip-flop change on the positive transition of the clock. A change in the information present at the data (D) input will not affect the output information at any other time due to master slave construction.

Input pulldown resistors eliminate the need to tie unused inputs to V_{EE}. Output rise and fall times have been optimized to provide relaxation of system design and layout criteria.

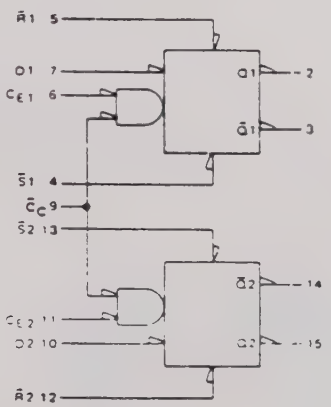
P_D = 235 mW typ/pkg (No Load)

f_{toggle} = 160 MHz typ

POSITIVE LOGIC



NEGATIVE LOGIC



V_{CC1} = Pin 1
V_{CC2} = Pin 16
V_{EE} = Pin 8

ECL MSI BI-QUINARY COUNTER

The MC10138 is a four bit counter capable of divide by two, five, or ten functions. It is composed of four set-reset master slave flip-flops. Clock inputs trigger on the positive going edge of the clock pulse.

Set or reset input override the clock, allowing asynchronous "set" or "clear". Individual set and common reset inputs are provided, as well as complementary outputs for the first and fourth bits. True outputs are available at all bits.

P_D = 370 mW typ/pkg (No Load)
f_{tog} = 150 MHz typ

V_{CC1} = Pin 1
V_{CC2} = Pin 16
V_{EE} = Pin 8

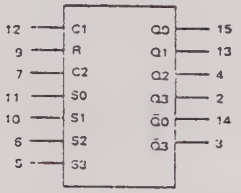
COUNTER TRUTH TABLES

BI-QUINARY
(Clock connected to C2
and Q3 connected to C1)

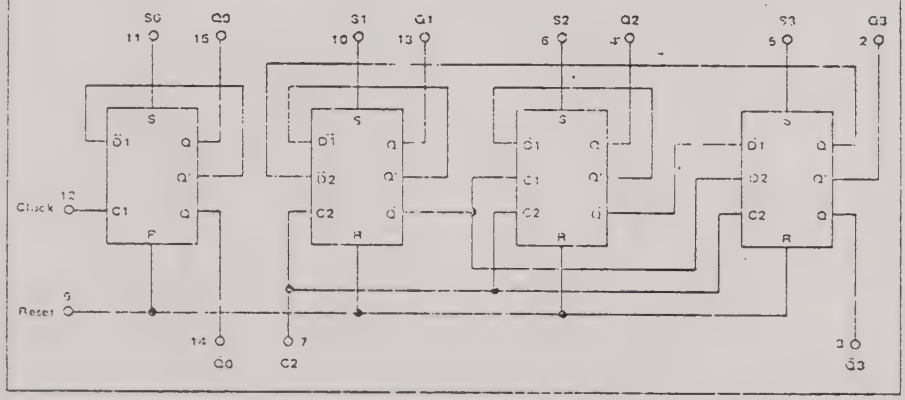
COUNT	Q1	Q2	Q3	Q0
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	H
6	L	H	H	H
7	H	H	H	H
8	L	L	L	H
9	H	L	L	H

BCD
(Clock connected to Q1
and Q0 connected to C2)

COUNT	Q0	Q1	Q2	Q3
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H



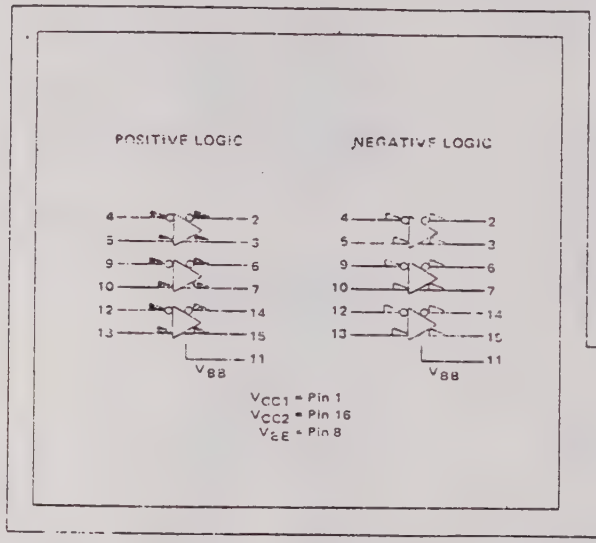
BLOCK DIAGRAM



ECL TRIPLE LINE DRIVER

MC10216L

S-D P/N 045276



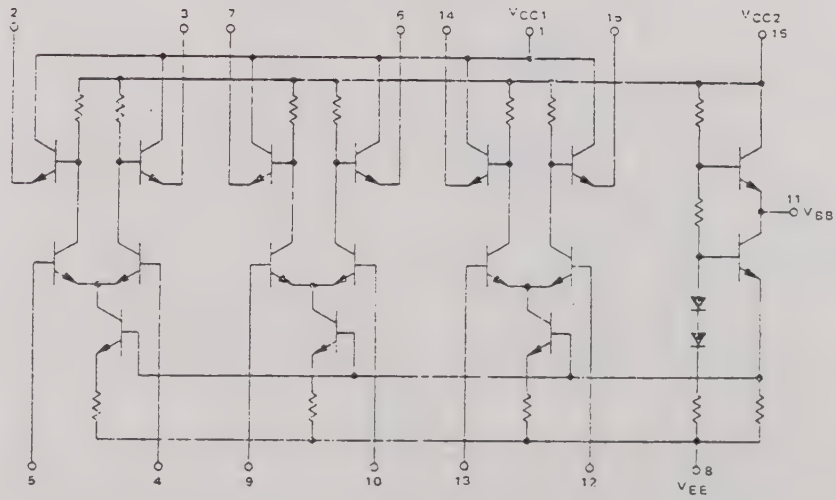
The MC10216 is a high speed triple differential amplifier designed for use in sensing differential signals over long lines. The base bias supply (V_{BB}) is made available at pin 11 to make the device useful as a Schmitt trigger, or in other applications where a stable reference voltage is necessary.

Active current sources provide the MC10216 with excellent common mode noise rejection. If any amplifier in a package is not used, one input of that amplifier must be connected to V_{BB} (pin 11) to prevent upsetting the current source bias network.

Complementary outputs are provided to allow driving twisted pair lines, to enable cascading of several amplifiers in a chain, or simply to provide complement outputs of the input logic function.

P_D = 100 mW typ/pkg (No Load)
t_{pd} = 1.8 ns typ (Single ended)
= 1.5 ns typ (Differential)

CIRCUIT SCHEMATIC



624XA-7-77

ECL HIGH SPEED D M-S FLIP-FLOP

R-S TRUTH TABLE

R	S	Q_{n+1}
L	L	Q_n
L	H	H
H	L	L
H	H	N.D.

N.D. = Not Defined

CLOCKED TRUTH TABLE

C	D	Q_{n+1}
L	↑	L
H	L	L
H	H	H

ϕ = Don't Care

C = $\overline{C_E}$ + C_C.

A clock H is a clock transition from a low to a high state.

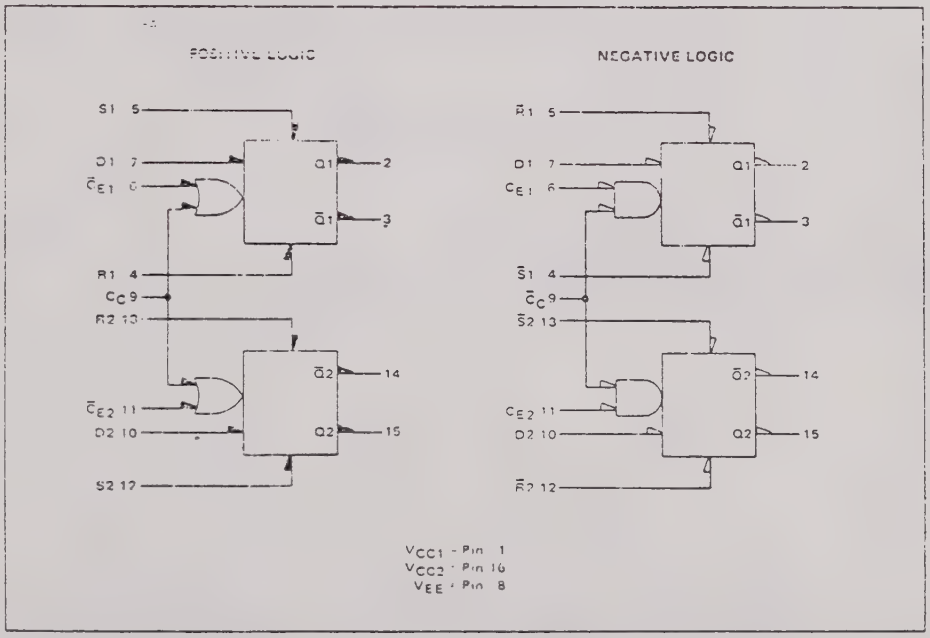
The MC10231 is a dual master-slave type D flip-flop. Asynchronous Set (S) and Reset (R) override Clock(C_C) and Clock Enable ($\overline{C_E}$) inputs. Each flip-flop may be clocked separately by holding the common clock in the low state and using the enable inputs for the clocking function. If the common clock is to be used to clock the flip-flop, the Clock Enable inputs must be in the low state. In this case, the enable inputs perform the function of controlling the common clock.

The output states of the flip-flop change on the positive transition of the clock. A change in the information present at the data (D) input will not affect the output information at any other time due to master slave construction.

Input pulldown resistors eliminate the need to tie unused inputs to V_{EE}. Output rise and fall times allow high frequency operation over 200 MHz.

P_D = 270 mW typ/pkg (No Load)

f_{Tog} = 225 MHz typ



MC14011CP

CMOS QUAD 2-INPUT NAND GATE

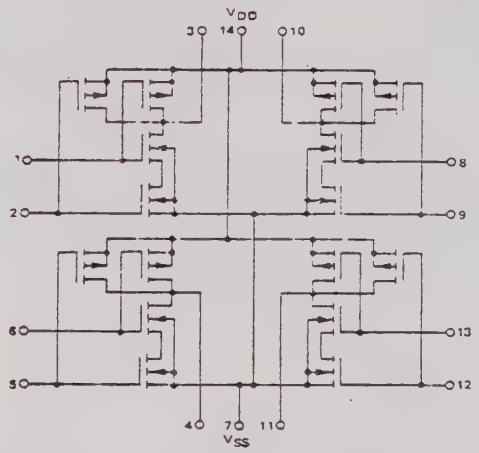
S-D P/N 103937

The MC14011 quad 2-input NAND gate finds primary use where low power dissipation and/or high noise immunity is desired.

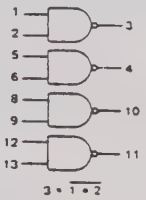
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

CIRCUIT SCHEMATIC



LOGIC DIAGRAM
POSITIVE LOGIC



$3 = \overline{1 \cdot 2}$

V_{DD} = Pin 14
V_{SS} = Pin 7

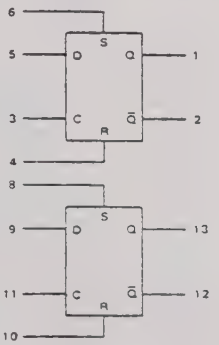
MC14013CP

CMOS DUAL D FLIP-FLOP

S-D P/N 103199

The MC14013 dual type D flip-flop is constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. Each flip-flop has independent Data, (D), Direct Set, (S), Direct Reset, (R), and Clock (C) inputs and complementary outputs (Q and $\bar{Q}$). These devices may be used as shift register elements or as type T flip-flops for counter and toggle applications.

BLOCK DIAGRAM



V_{DD} = Pin 14
V_{SS} = Pin 7

TRUTH TABLE

INPUTS				OUTPUTS		
CLOCK†	DATA	RESET	SET	Q	Q̄	
⎍	0	0	0	0	1	
⎍	1	0	0	1	0	
⎎	X	0	0	Q	Q̄	No Change
X	X	1	0	0	1	
X	X	0	1	1	0	
X	X	1	1	1	1	

X = Don't Care
† = Level Change

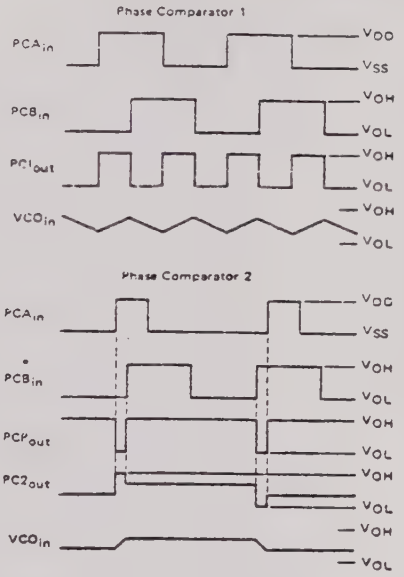
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

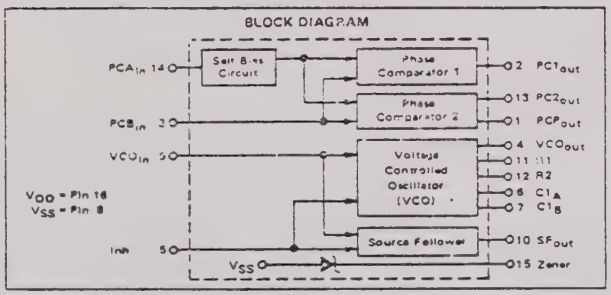
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

The MC14046 phase-locked loop contains two phase comparators, a voltage-controlled oscillator (VCO), source follower, and zener diode. The comparators have two common signal inputs. PCA_{in} and PCB_{in}. Input PCA_{in} can be used directly coupled to large voltage signals, or indirectly coupled (with a series capacitor) to small voltage signals. The self-bias circuit adjusts small voltage signals in the linear region of the amplifier. Phase comparator 1 (an exclusive OR gate) provides a digital error signal $PC1_{out}$, and maintains 90° phase shift at the center frequency between PCA_{in} and PCB_{in} signals (both at 50% duty cycle). Phase comparator 2 (with leading edge sensing logic) provides digital error signals $PC2_{out}$ and PCP_{out}, and maintains a 0° phase shift between PCA_{in} and PCB_{in} signals (duty cycle is immaterial). The linear VCO produces an output signal VCO_{out} whose frequency is determined by the voltage of input VCO_{in} and the capacitor and resistors connected to pins $C1_A$, $C1_B$, R1, and R2. The source-follower output SF_{out} with an external resistor is used where the VCO_{in} signal is needed but no loading can be tolerated. The inhibit input Inh, when high, disables the VCO and source follower to minimize standby power consumption. The zener diode can be used to assist in power supply regulation.

Applications include FM and FSK modulation and demodulation, frequency synthesis and multiplication, frequency discrimination, tone decoding, data synchronization and conditioning, voltage-to-frequency conversion and motor speed control.

Waveforms

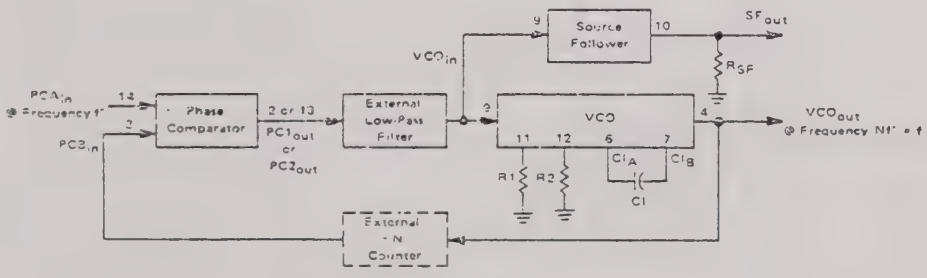




This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Pins 6, 7, 10, 11, 12, and 15 if unused must be left open.

GENERAL PHASE-LOCKED LOOP CONNECTIONS AND WAVEFORMS

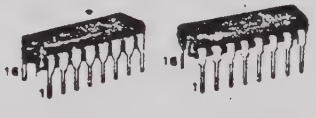


CMOS HEX INVERTER/BUFFER

HEX BUFFERS

The MC14049 hex inverter/buffer and MC14050 noninverting hex buffer are constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. These complementary MOS devices find primary use where low power dissipation and/or high noise immunity is desired. These devices provide logic-level conversion using only one supply voltage, V_{CC}. The input-signal high level (V_{IH}) can exceed the V_{CC} supply voltage for logic-level conversions. Two TTL/DTL loads can be driven when the devices are used as CMOS-to-TTL/DTL converters (V_{CC} = 5.0 V, $V_{OL} \leq$ 0.4 V, $I_{OL} \geq$ 3.2 mA). Note that pin 16 is not connected internally on these devices; consequently connections to this terminal will not affect circuit operation.

- Direct Drive of Two TTL/DTL Loads
- High Source and Sink Currents
- High-to-Low or Low-to-High Level Converter
- Quiescent Power Dissipation = 5 nW/package typical @ 5 Vdc
- Single-Supply, Pin-for-Pin Replacements for Types MC14009 and MC14010 Respectively



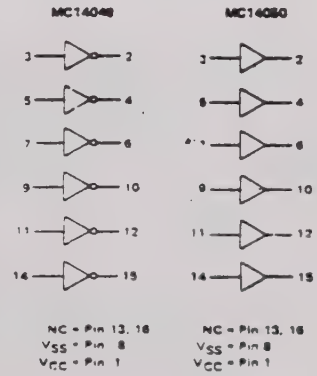
L SUFFIX
CERAMIC PACKAGE
CASE 620

P SUFFIX
PLASTIC PACKAGE
CASE 648

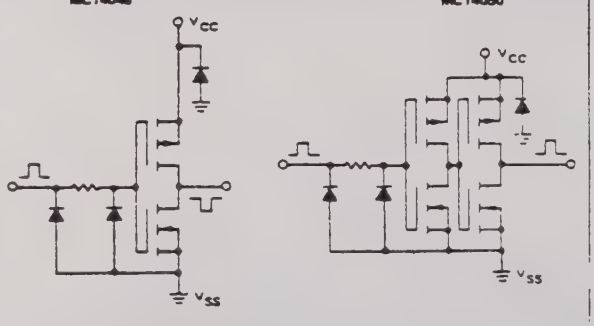
MAXIMUM RATINGS (Voltages referenced to V_{SS}, Pin 8)

Rating		Symbol	Value	Unit
DC Supply Voltage	AL Version	V_{CC}	+18 to -0.5	Vdc
	CL,CP Version		+16 to -0.5	
Input Voltage, All Inputs		V_{in}	+18 to -0.5	Vdc
DC Current per Input Pin		I_{in}	10	mAdc
DC Current per Output Pin		I_{out}	45	mAdc
Operating Temperature Range	AL Version	T_A	-55 to +125	°C
	CL,CP Version		-40 to +85	
Storage Temperature Range		T_{stg}	-65 to +150	°C
Maximum Dissipation per Package		P_D	See Figure 1	

LOGIC DIAGRAMS



CIRCUIT SCHEMATIC
(1/6 OF CIRCUIT SHOWN)



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields, however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{CC}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g. either V_{SS} or V_{CC}).

CMOS QUAD 2-INPUT AND GATE

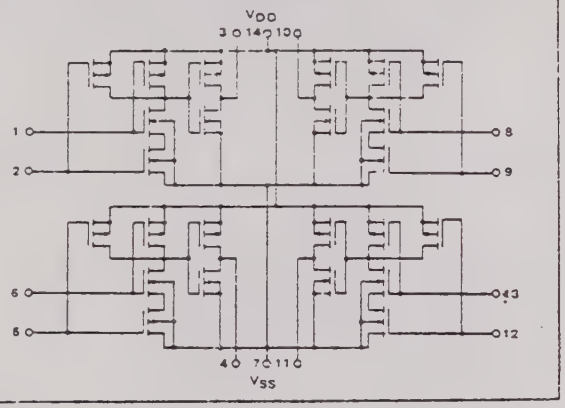
MC14081BCP — **S-D P/N 116101**

The MC14081 quad 2-input AND gate is constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. These complementary MOS logic gates find primary use where low power dissipation and/or high noise immunity is desired.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

CIRCUIT SCHEMATIC



LOGIC DIAGRAM

3 = 1 • 2

V_{DD} = Pin 14
V_{SS} = Pin 7

CMOS DUAL 4-BIT LATCH

MC14508BCP — **S-D P/N 117257**

The MC14508 dual 4-bit latch is constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. The part consists of two identical, independent 4-bit latches with separate Strobe (ST) and Master Reset (MR) controls. Separate Disable inputs force the outputs to a high impedance state and allow the devices to be used in time sharing bus line applications.

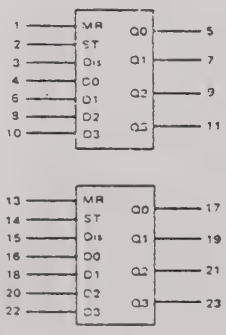
These complementary MOS latches find primary use in buffer storage, holding register, or general digital logic functions where low power dissipation and/or high noise immunity is desired.

TRUTH TABLE

MR	ST	Disable	D3	D2	D1	D0	Q3	Q2	Q1	Q0
0	1	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	1	0	0	0	1
0	1	0	0	0	1	0	0	0	1	0
0	1	0	0	1	0	0	0	1	0	0
0	1	0	1	0	0	0	1	0	0	0
0	0	0	X	X	X	X	latched			
1	X	0	X	X	X	X	0	0	0	0
X	X	1	X	X	X	X	high impedance			

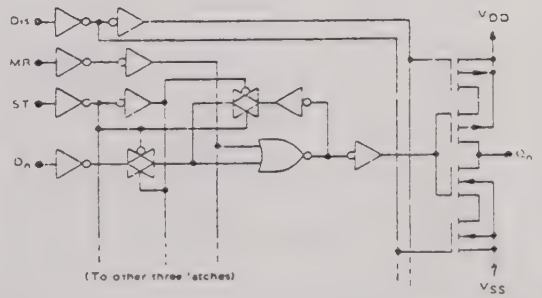
X = Don't Care

BLOCK DIAGRAM



V_{DD} = Pin 24
V_{SS} = Pin 12

CIRCUIT DIAGRAM



CMOS 8-CHANNEL DATA SELECTOR

MC14512CP

S-D P/N 103942

The MC14512 is an 8-channel data selector constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. This data selector finds primary application in signal multiplexing functions. It may also be used for data routing, digital signal switching, signal gating, and number sequence generation.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

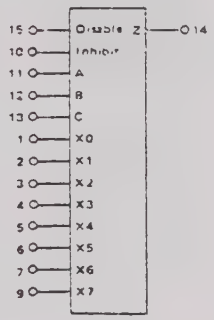
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

TRUTH TABLE

C	B	A	INHIBIT	DISABLE	Z
0	0	0	0	0	X0
0	0	1	0	0	X1
0	1	0	0	0	X2
0	1	1	0	0	X3
1	0	0	0	0	X4
1	0	1	0	0	X5
1	1	0	0	0	X6
1	1	1	0	0	X7
ϕ	ϕ	ϕ	1	0	0
ϕ	ϕ	ϕ	ϕ	1	High Impedance

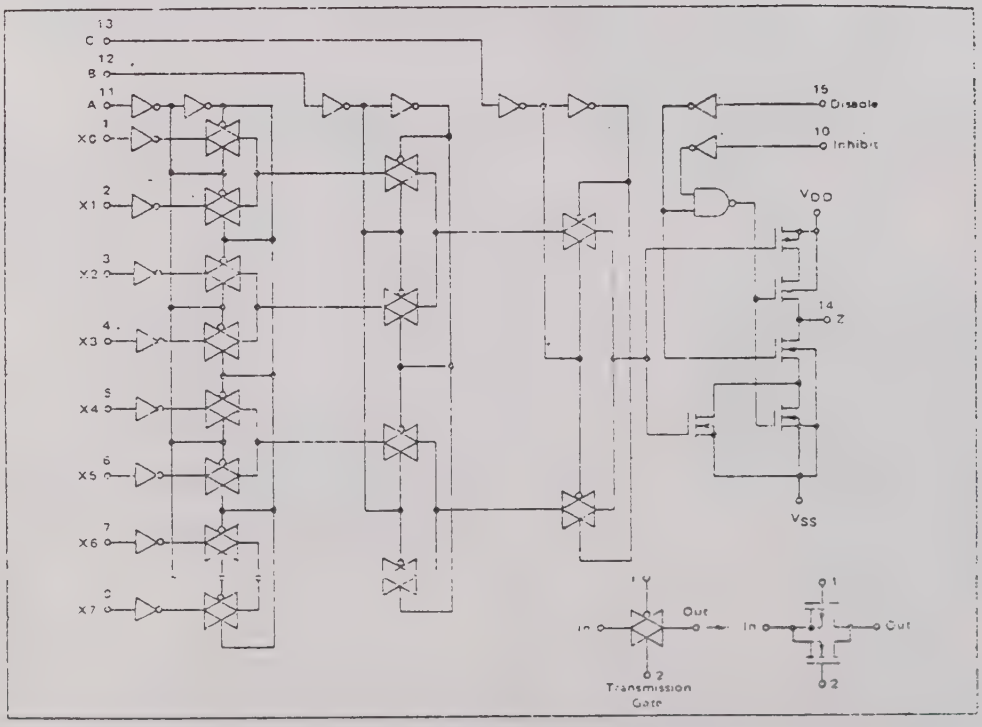
ϕ = Don't Care

BLOCK DIAGRAM



V_{DD} = Pin 16
V_{SS} = Pin 8

LOGIC DIAGRAM



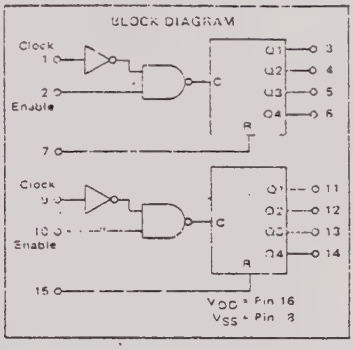
MC14518CP
MC14520CP

CMOS DUAL BCD UP COUNTER
CMOS DUAL BINARY UP COUNTER

S-D P/N 103339
S-D P/N 117278

The MC14518 dual BCD counter and the MC14520 dual binary counter are constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. Each consists of two identical, independent, internally synchronous 4 stage counters. The counter stages are type D flip-flops, with interchangeable Clock and Enable lines for incrementing on either the positive-going or negative-going transition as required when cascading multiple stages. Each counter can be cleared by applying a high level on the Reset line. In addition, the MC14518 will count out of all undefined states within two clock periods. These complementary MOS up counters find primary use in multi-stage synchronous or ripple counting applications requiring low power dissipation and/or high noise immunity.

BLOCK DIAGRAM

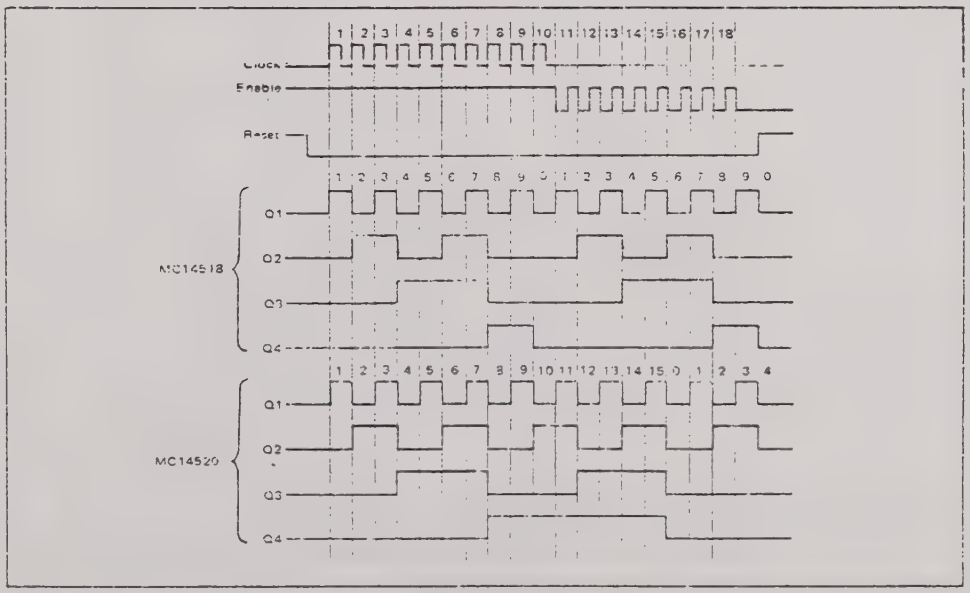


TRUTH TABLE

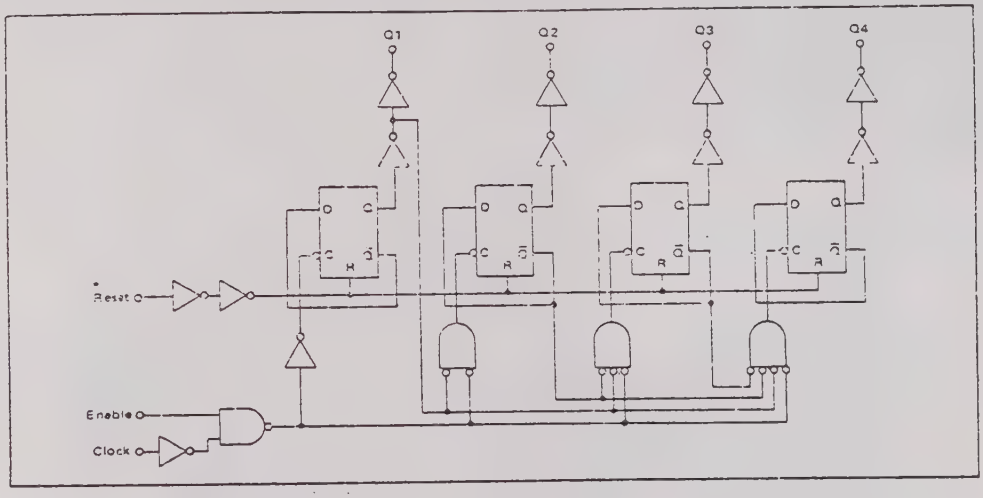
CLOCK	ENABLE	RESET	ACTION
⌐¯	1	0	Increment Counter
0	¯⌐	0	Increment Counter
¯⌐	X	0	No Change
X	⌐¯	0	No Change
⌐¯	0	0	No Change
1	¯⌐	0	No Change
X	X	1	Q1 thru Q4 = 0

X = Don't Care

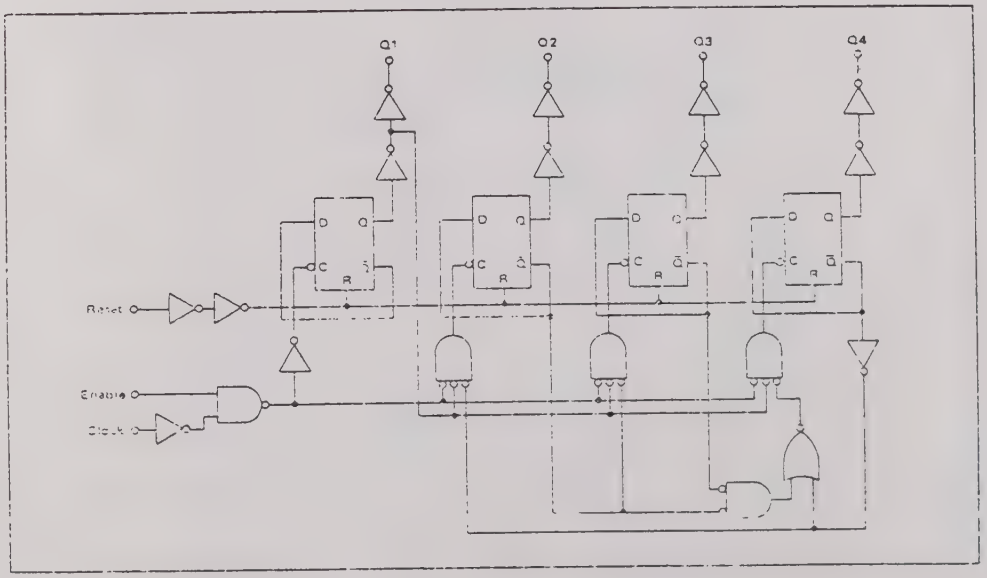
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).



BINARY COUNTER (MC14520) LOGIC DIAGRAM
(1/2 OF DEVICE SHOWN)



DECADE COUNTER (MC14518) LOGIC DIAGRAM
(1/2 OF DEVICE SHOWN)



CMOS PROGRAMMABLE ÷N COUNTER

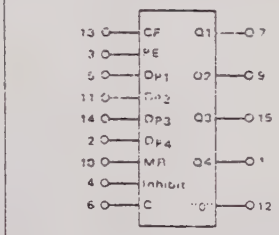
MC14526BCP **S-D P/N 117144**

The MC14522 BCD counter and the MC14526 binary counter are constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure.

These devices are programmable, cascadable down counters with a decoded "0" state output for divide-by-N applications. In single stage applications the "0" output is applied to the Preset Enable input. The Cascade Feedback input allows cascade divide-by-N operation with no additional gates required. The Master Reset function provides synchronous initiation of divide-by-N cycles. The Clock Inhibit input allows disabling of the pulse counting function.

These complementary MOS counters can be used in frequency synthesizers, phase locked loops, and other frequency division applications requiring low power dissipation and/or high noise immunity.

BLOCK DIAGRAM



V_{DD} = Pin 16
V_{SS} = Pin 8

TRUTH TABLES

BOTH TYPES

Clock	Inhibit	Preset Enable	Master Reset	Action
0	0	0	0	No Count
⌐	0	0	0	Count
⌐	1	0	0	No Count
1	¬	0	0	Count
X	X	1	0	Preset
X	X	X	1	Reset

MC14522

Count	Output Q4	Q3	Q2	Q1
9	1	0	0	1
8	1	0	0	0
7	0	1	1	1
6	0	1	1	0
5	0	1	0	1
4	0	1	0	0
3	0	0	1	1
2	0	0	1	0
1	0	0	0	1
0	0	0	0	0

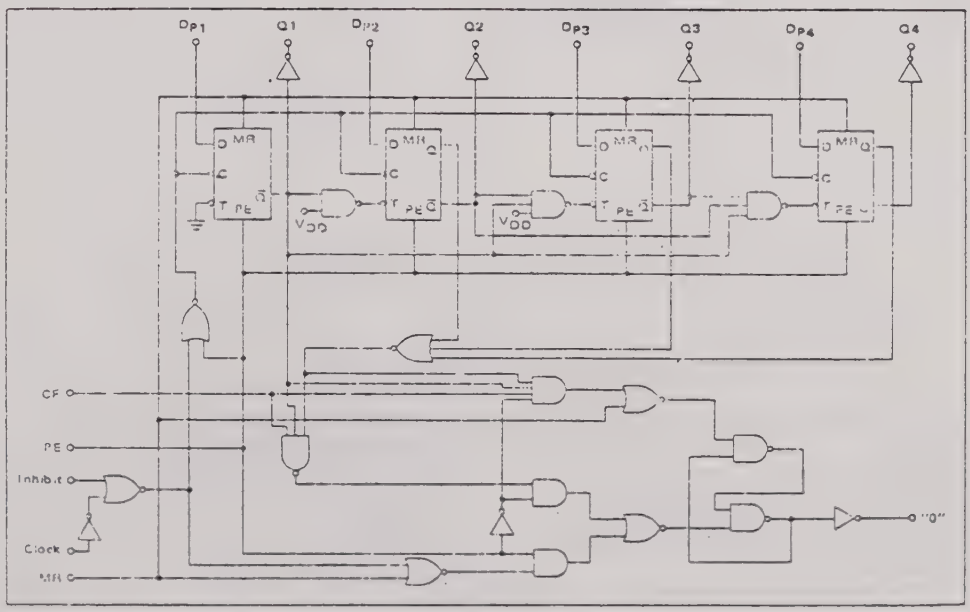
MC14526

Count	Output Q4	Q3	Q2	Q1
15	1	1	1	1
14	1	1	1	0
13	1	1	0	1
12	1	1	0	0
11	1	0	1	1
10	1	0	1	0
9	1	0	0	1
8	1	0	0	0
7	0	1	1	1
6	0	1	1	0
5	0	1	0	1
4	0	1	0	0
3	0	0	1	1
2	0	0	1	0
1	0	0	0	1
0	0	0	0	0

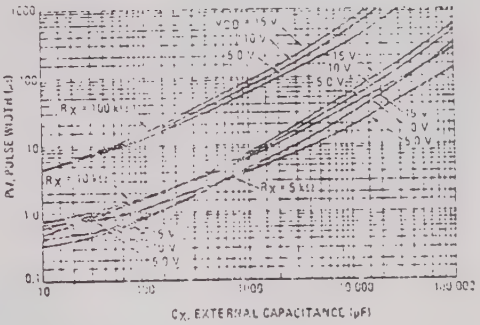
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} and V_{out} be constrained to the range $V_{SS} \le (V_{in}$ or $V_{out}) \le V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

MC14526 LOGIC DIAGRAM (Binary Divide-by-N Counter)



PULSE WIDTH versus C_X



DUAL MONOSTABLE MULTIVIBRATOR

The MC14528 is a dual, retriggerable, resettable monostable multivibrator. It may be triggered from either edge of an input pulse, and will produce an accurate output pulse over a wide range of widths, the duration and accuracy of which are determined by the external timing components, C_X and R_X.

- Separate Reset Available
- Low Quiescent Power Dissipation – 25 nW @ 5.0 Vdc
- Diode Protection on All Inputs
- Triggerable from Leading or Trailing Edge Pulse

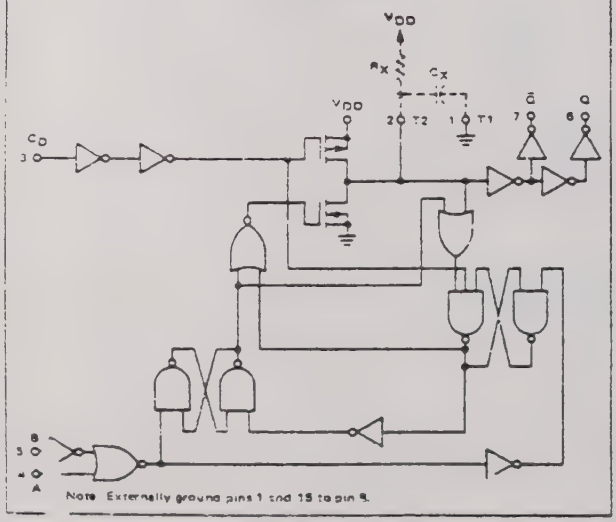
L SUFFIX
CERAMIC PACKAGE
CASE 620

P SUFFIX
PLASTIC PACKAGE
CASE 648

MAXIMUM RATINGS (Voltages referenced to V_{SS}, Pin 8)

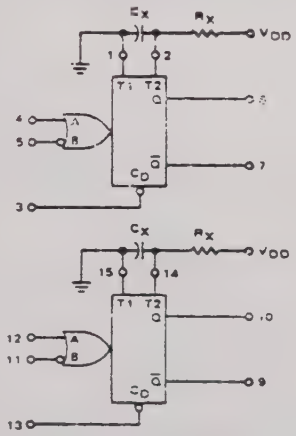
Rating		Symbol	Value	Unit
DC Supply Voltage	MC14528AL MC14528CL/CP	V_{DD}	+18 to -0.5 +15 to -0.5	Vdc
Input Voltage, All Inputs		V_{in}	V_{DD} +0.5 to -0.5	Vdc
DC Current Drain per Pin		I	10	mAdc
Operating Temperature Range	– MC14528AL – MC14528CL/CP	T_A	-55 to +125 -40 to +85	°C
Storage Temperature Range		T_{stg}	-65 to +150	°C

LOGIC DIAGRAM
(1/2 of Device Shown)



Note: Externally ground pins 1 and 15 to pin 8.

BLOCK DIAGRAM



R_X and C_X are external components.

V_{DD} = Pin 16
V_{SS} = Pin 8

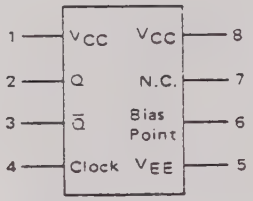
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit. For proper operation it is recommended that V_{in} or V_{out} be constrained to the range $V_{SS} \leq (V_{in}$ or $V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}).

1 GHz DECADE COUNTER

MC1697P

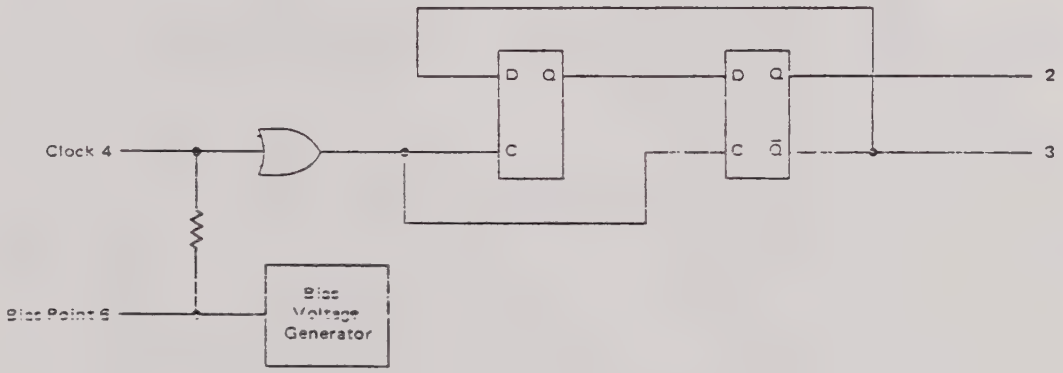
S-D P/N 103872



P SUFFIX
PLASTIC PACKAGE

V_{CC1} = Pin 1
V_{CC2} = Pin 8
V_{EE} = Pin 5

Power Dissipation = 320 mW Typ/Pkg
(No Load — 7.0 V Supply)



The MC1697 is a divide-by-four gigahertz prescaler in an 8 pin plastic package. The clock input requires an ac coupled driving signal of 800 mV amplitude (typical). The clock toggles two divide-by-two stages, and the complementary outputs (50% duty cycle) are taken from the second stage. The complementary outputs are capable of driving 50-ohm lines.

Pin 6 is available for connection of a decoupling capacitor to ground. This capacitor stabilizes the reference point which is internally coupled to the clock input.

+5V VOLTAGE REGULATOR

MC7805CP

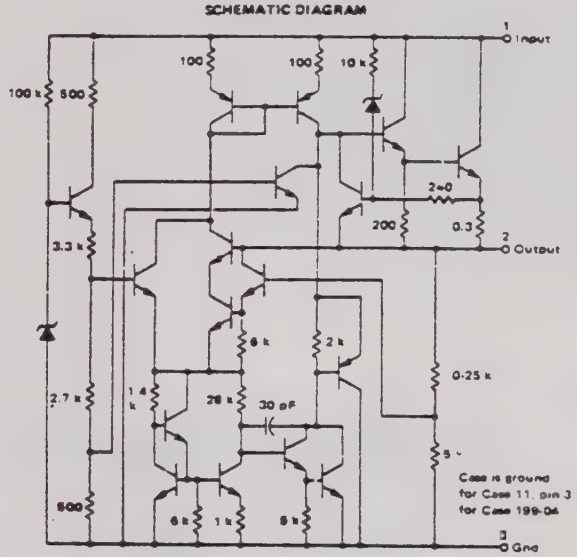
S-D P/N 045256

P SUFFIX
PLASTIC PACKAGE
CASE 199-04

Pin 1 Input (Base)
Pin 2 Output (Emitter)
Pin 3 Ground (Collector)

Heat sink surface connected to pin 3

SCHEMATIC DIAGRAM



+15V VOLTAGE REGULATOR

MC7815CP

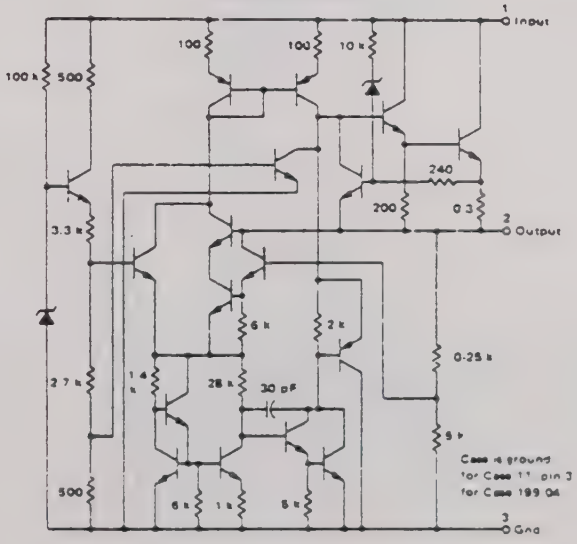
S-D P/N 103039

P SUFFIX
PLASTIC PACKAGE
CASE 199-04

Pin 1 Input (Base)
Pin 2 Output (Emitter)
Pin 3 Ground (Collector)

Heat sink surface connected to pin 3

SCHEMATIC DIAGRAM



MC7902CP	-2V VOLTAGE REGULATOR	S-D P/N 103944
MC79L05ACP	-4.8 to -5.2 LOW POWER VOLTAGE REGULATOR	S-D P/N 117014
MC7905.2CP	-5.2V VOLTAGE REGULATOR	S-D P/N 103033

MC7900C SERIES THREE-TERMINAL NEGATIVE VOLTAGE REGULATORS

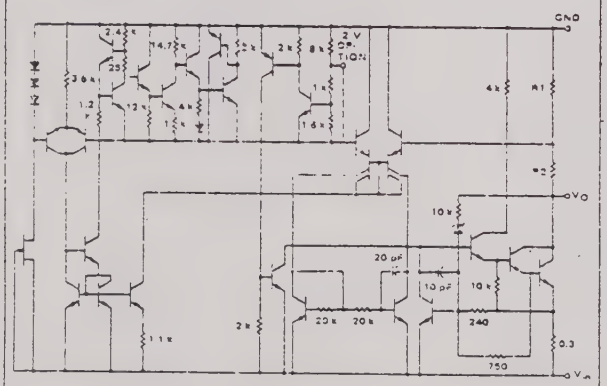
The MC7900C Series of fixed output negative voltage regulators are intended as complements to the popular MC7800C Series devices. These negative regulators are available in the same seven-voltage options as the MC7800C devices. In addition, two extra voltage options commonly employed in MECL systems are also available in the negative MC7900C Series.

Available in fixed output voltage options from -2.0 to -24 volts, these regulators employ current limiting, thermal shutdown, and safe-area compensation – making them remarkably rugged under most operating conditions. With adequate heat-sinking they can deliver output currents in excess of 1.0 ampere.

- No External Components Required
- Internal Thermal Overload Protection
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation
- Packaged in the Plastic Case 199-04
  (Pin Compatible with the VERSAWATT† or TO-220)
  Or Hermetic TO-3 Type Metal Power Package

K SUFFIX
METAL PACKAGE
CASE 11-01
(TO-3 TYPE)

SCHEMATIC DIAGRAM

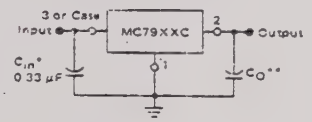


P SUFFIX
PLASTIC PACKAGE
CASE 199-04

Pin 1 GND (B)
Pin 2 Output (E)
Pin 3 Input (C)

Heat sink surface connected to pin 3.

STANDARD APPLICATION



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0 V more negative even during the high point on the input ripple voltage.

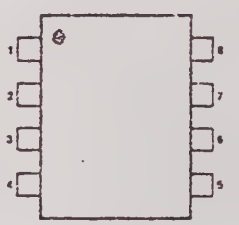
XX = these two digits of the type number indicate voltage.

* = C_{in} is required if regulator is located an appreciable distance from power supply filter.

** = C_O improves stability and transient response.

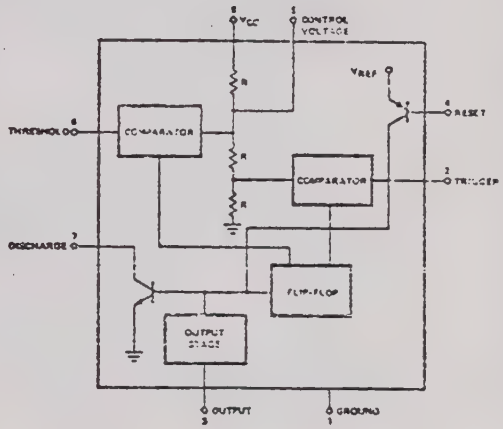
DEVICE TYPE/NOMINAL OUTPUT VOLTAGE

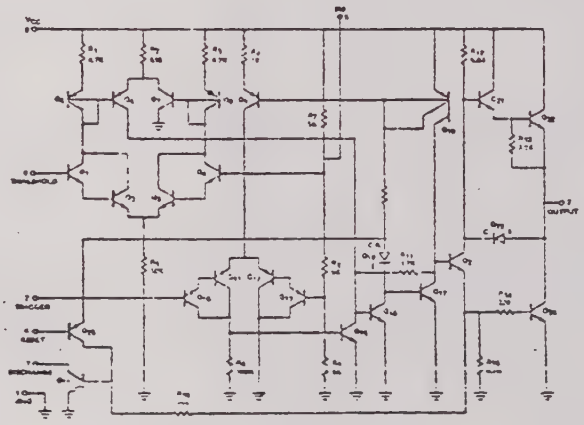
MC7902C - 2.0 Volts	MC7906C - 6.0 Volts	MC7915C - 15 Volts
MC7905C - 5.0 Volts	MC7908C - 8.0 Volts	MC7918C - 18 Volts
MC7905.2C - 5.2 Volts	MC7912C - 12 Volts	MC7924C - 24 Volts



V PACKAGE
(Top View)

1. Ground
2. Trigger
3. Output
4. Reset
5. Control Voltage
6. Threshold
7. Discharge
8. V_{CC}





CMOS LSI COUNT CHAIN/MULTIPLEXER

SD055095 S-D P/N 055095

The circuitry of this 40-pin CMOS Decade Count Chain contains; a six decade divider chain, an over-flow detector, 33-Bit Storage register, a multiplex, an adjustable multiplex free-running M.V. clock, a blank code generator/decimal point activator, and a clock selector allowing for the provision to break the decade chain into two chains of three decades each.

Listed by pin number are the inputs and outputs of the device, with signal name and functional details.

PIN NO.	SIGNAL NAME	FUNCTION
1	TEST CLOCK ENABLE	Allows the three MSD of the decade chain to be driven by the TEST CLOCK when set high.
2	TEST CLOCK	Clock input to the 3rd MSD of the count chain, enabled when the TEST CLOCK ENABLE is set high.
3	LSD 8	LSD Bit "8" input.
4	LSD 4	LSD Bit "4" input.
5	LSD 2	LSD Bit "2" input.
6	LSD 1	LSD Bit "1" input.
7	DECADE CLOCK	Clock input to the LSD decade of the count chain.
8	Not Used	
9	Not Used	
10	SLSD 8	NLSD Bit "8" input.
11	SLSD 4	NLSD Bit "4" input.
12	SLSD 2	NLSD Bit "2" input
13	SLSD 1	NLSD Bit "1" input.
14	Not Used	
15	Vcc	+voltage supply input +4.5 to +5.5 Vdc 50 mV p-p ripple or noise.
16	BCD1	Multiplexed BCD Bit "1" output.
17	BCD2	Multiplexed BCD Bit "2" output.
18	SUPPLEMENTAL OUTPUT	Carry from the NMSD of the count chain.
19	BCD 4	Multiplexed BCD Bit "4" output.
20	BCD 8	Multiplexed BCD Bit "8" output.
21	BLACK CODE	Indicates that the LSD was present on the BCD output pins. The BLANK CODE will reset (go to logic high) on the detection of the first of the following three conditions; 1) Detection of an Over Flow.

SD055095 (Contd)

PIN NO.	SIGNAL NAME	FUNCTION
		2) Detection of a logic high on any of the BCD outputs. 3) Detection of a coincidence of any of the position and Octal Code listed as follows:

Position	Octal Code
1	7
2	6
3	5
4	4
5	3
6	2
7	1
8	0

22	DECIMAL POINT	A decimal point actuation when position output coincides with the proper octal code input.
23 24 25	OCTAL CODE BIT 4 OCTAL CODE BIT 2 OCTAL CODE BIT 1	The octal code inputs can be considered as static logic levels, they may be changed at any time, but will not effect outputs until the completion of a full multiplexer cycle.
26	OVER FLOW	Indicates that the MSD of the count chain has generated a carry. This function must be reset by a Master Reset on pin 40, to return it to its logic low state.
27	STORE	True (Active) level 0 to +5 Vdc. False level +2.5 Vdc to Vcc. Requires a pulse duration of 1 µs. When placed at a static true (logic low) the 33 storage registers will follow their data inputs.
28	MULTIPLEX RATE CONTROL	When connected to an external timing capacitor, it will allow the multiplexer M.V. to free-run between 2 kHz to 32 kHz, depending on the value of the capacitor. When connected to an external clock it will allow triggering of the M.V. (2 kHz to 32 kHz).
29	PT/NT	When placed at ground it configures the position outputs to 0 volts true (negative transition). When left open or pulled up to Vcc configures the position outputs to Vcc true (position transistion).
30 31 32	POS1 POS2 POS4	Position outputs are negative true when pin 29 is at ground, and positive true when pin 29 is left open or pulled up to Vcc.

SD055095 (Contd)

PIN NO.	SIGNAL NAME	FUNCTION
33	POS3	
34	POS6	
35	Not Used	
36	POS5	
37	POS8	
38	POS7	
39	GND	Provides the ground return for the Vcc supply.
40	RESET	Will reset the six decade counters of the count chain and the over-flow detector, when placed at a logic low (0 Vdc to +0.5 Vdc for a duration of 1 µs.

TTL PROM (74188A) DECIMAL AND MEASUREMENT UNIT

description

The SN74188A is a field-programmable, 256-bit, read-only memory organized as 32 words of eight bits each. This monolithic, high-speed, transistor-transistor-logic (TTL) memory array is addressed in five-bit binary with full on-chip decoding. An overriding memory-enable input is provided which, when taken high, will inhibit the function causing all eight outputs to remain high. The organization is expandable to 1,856 words of n-bits with no additional output buffering.

The address of an eight-bit word is accomplished through the buffered binary select inputs in coincidence with a low logic level at the enable input. Where multiple SN74188A devices are used in a memory system, the enable input allows easy decoding of additional address bits.

Data can be electronically programmed, as desired, at any of the 256 bit locations of the SN74188A in accordance with the programming procedure specified. Prior to programming, the memory contains a low-logic-level output condition at all 256 bit locations. The programming procedure open-circuits metal links which results in a high-logic-level output at selected locations. The procedure is irreversible and, once altered, the output for that bit is permanently programmed to provide a high logic level. Outputs never having been altered may later be programmed to supply a high-level output. Operation of the unit within the recommended operating conditions will not alter the memory content.

The open-collector outputs are capable of sinking 12 milliamperes of current and may be wire-AND-connected to other memories to increase the number of words without additional output buffering. External pull up resistors should be used to improve noise margin and dynamic response. The best low-to-high propagation delay time is achieved when using minimum R_L (see Table I).

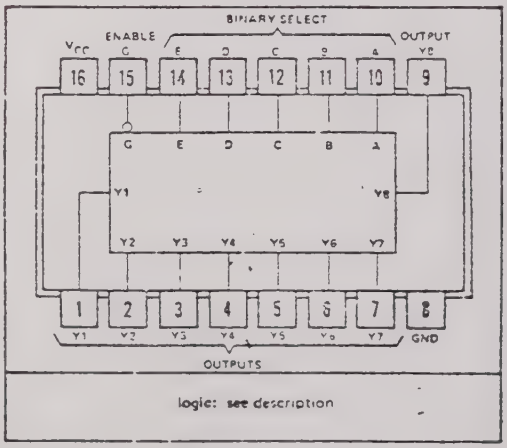
The mask-programmable SN7488A can be used to replace the SN74188A as they are functionally and mechanically identical. Likewise, most applications currently using the SN7488A can utilize the SN74188A as a direct replacement where field programming is desired.

TABLE 1
WORD CAPACITY vs TTL LOADS
(V_{CC} = 5 V, T_A = 0°C to 70°C)

LOADS	MIN R_L (Ω)	MAX NO. WIRE-ANDS†	MAX NO. OF WORDS
1	442	58	1856
2	522	49	1568
3	639	39	1248
4	821	30	960
5	1150	20	640
6	1916	10	320
7	5750	2	64

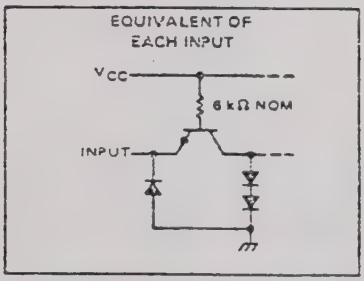
† Total number of SN74188A outputs connected to each common bus.

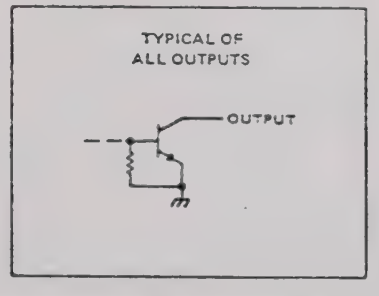
J OR N
DUAL-IN-LINE PACKAGE (TOP VIEW)



logic: see description

schematics of inputs and outputs





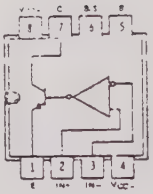
SD055998 (Contd)

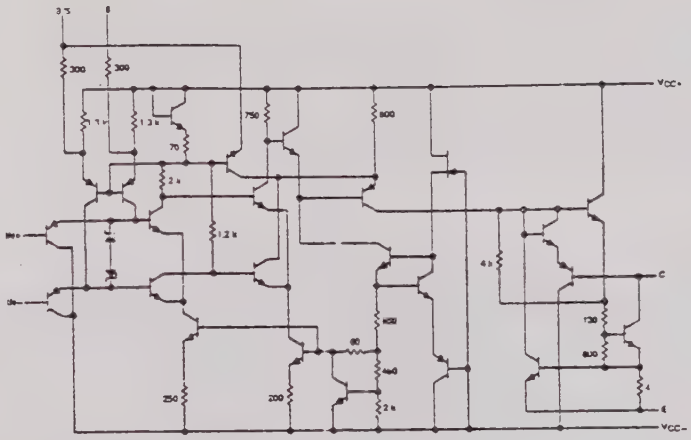
Function	A	B	C	D	E	Resolution	Decimal 1 (Y_1)	Decimal 2 (Y_2)	Decimal 4 (Y_3)	Hz (Y_4)	kHz (Y_5)	MHz (Y_6)	Enable Mult (Y_7)	Prescale (Y_8)
Direct	1	1	0	0	1	1 kHz	0	0	0	1	0	1	0	1
	0	0	1	0	1	100 Hz	1	0	0	1	0	1	0	1
	1	0	1	0	1	10 Hz	0	1	0	1	0	1	0	1
	0	1	1	0	1	1 Hz	1	1	0	1	0	1	0	1
	1	1	1	0	1	.1 Hz	0	0	1	1	0	1	0	1
Prescale	1	1	0	1	1	1 kHz	1	1	0	1	1	0	0	0
	0	0	1	1	1	100 Hz	0	0	1	1	1	0	0	0
	1	0	1	1	1	10 Hz	1	0	1	1	1	0	0	0
	0	1	1	1	1	1 Hz	0	1	1	1	1	0	0	0
	1	1	1	1	1	.1 Hz	1	1	1	1	1	0	0	0
Mult X100	1	1	0	1	0	1 kHz	0	1	0	1	0	1	0	1
	0	0	1	1	0	100 Hz	0	0	0	0	1	1	0	1
	1	0	1	1	0	10 Hz	1	0	0	0	1	1	1	1
	0	1	1	1	0	1 Hz	0	1	0	0	1	1	1	1
	1	1	1	1	0	.1 Hz	1	1	0	0	1	1	1	1
Acto	1	1	0	0	0	1 kHz	1	1	0	1	1	0	1	1
	0	0	1	0	0	100 Hz	0	0	1	1	1	0	1	1
	1	0	1	0	0	10 Hz	1	0	1	1	1	0	1	1
	0	1	1	0	0	1 Hz	0	1	1	1	1	0	1	1
	1	1	1	0	0	.1 Hz	1	1	1	1	1	0	1	1

LINEAR DIFFERENTIAL VOLTAGE COMPARATOR

SN72311P **S-D P/N 103942**

schematic





B	Balance
B/S	Balance/Strobe
C	Collector Output
E	Emitter Output
IN+	Noninverting Input
IN−	Inverting Input
NC	No Internal Connection
V_{CC+}	Positive Supply Voltage
V_{CC-}	Negative Supply Voltage

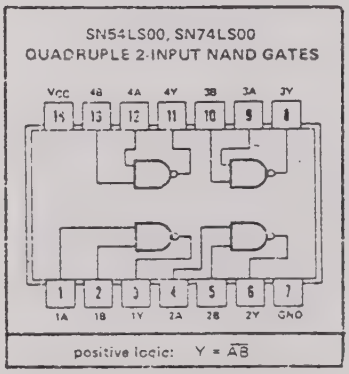
Resistor values shown are nominal and in ohms.

The SN52111 and SN72311 are single high-speed voltage comparators. These devices are designed to operate from a wide range of power supply voltage, including ±15-volt supplies for operational amplifiers and 5-volt supplies for logic systems. The output levels are compatible with most DTL, TTL, and MOS circuits. These comparators are capable of driving lamps or relays and switching voltages up to 50 volts at 50 milliamperes. All inputs and outputs can be isolated from system ground. The outputs can drive loads referenced to ground, V_{CC+}, or V_{CC-}. Offset balancing and strobe capability are available and the outputs can be wire-OR connected. If the strobe input is low, the output will be in the off state regardless of the differential input. Although slower than the SN52506 and SN52514, these devices are not as sensitive to spurious oscillations.

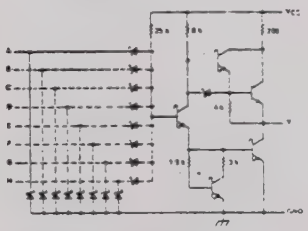
The SN52111 is characterized for operation over the full military temperature range of −55°C to 125°C; the SN72311 is characterized for operation from 0°C to 70°C.

TTL LOW POWER SCHOTTKLY DUAL 2-INPUT NAND GATE

SN74LS00N **S-D P/N 103130**


SN54LS00, SN74LS00
QUADRUPLE 2-INPUT NAND GATES
VCC 4B 4A 4Y 3B 3A 3Y
14 13 12 11 10 9 8
1 2 3 4 5 6 7
1A 1B 1Y 2A 2B 2Y GND
positive logic: Y = $\overline{AB}$

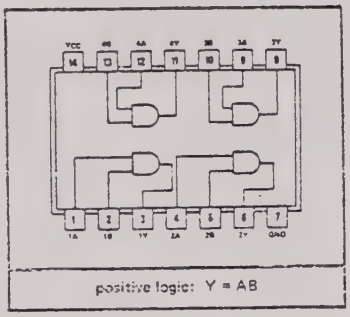
schematic (each gate)



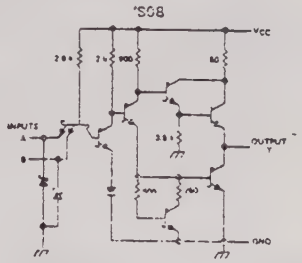
Resistor values shown are nominal and in ohms

TTL LOW POWER SCHOTTKLY QUAD 2-INPUT AND GATE

SN74LS08 **S-D P/N 103967**



schematics (each gate)

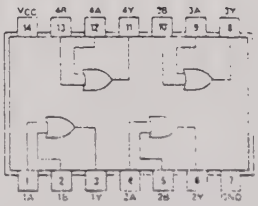


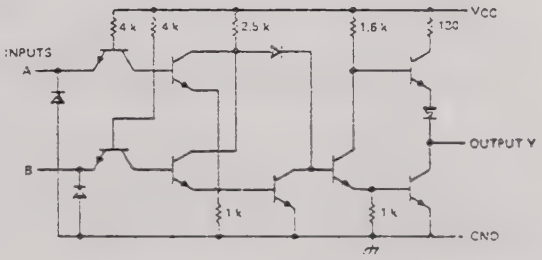
Resistor values shown are nominal and in ohms.

TTL LOW POWER 2-INPUT QUAD NOR GATE

SN74L32N **S-D P/N 103972**

schematics (each gate)

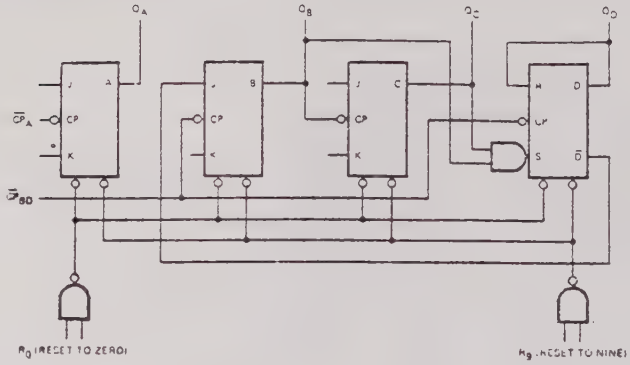




Resistor values shown are nominal and in ohms.

TTL MSI DECADE COUNTER

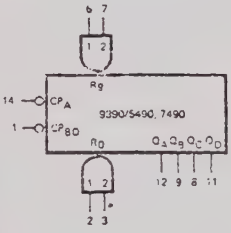
SN7490N **S-D P/N 025732**



PIN NAMES

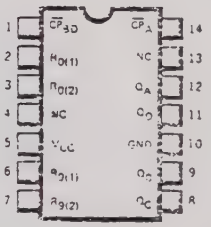
R_0	Reset-Zero Inputs
R_9	Reset-Nine Inputs
$\overline{CP}_A$	Clock Input
$\overline{CP}_{BD}$	Clock Input
Q_A, Q_B, Q_C, Q_D	Outputs

LOGIC SYMBOL



V_{CC} = Pin 5
GND = Pin 10
NC = Pin 4, 13

CONNECTION DIAGRAM
DIP (TOP VIEW)



TRUTH TABLES

BCD COUNT SEQUENCE (Note 1)

COUNT	OUTPUT Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

RESET/COUNT (see Note 2)

RESET INPUTS $R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	OUTPUT Q_D Q_C Q_B Q_A
H	H	L	X	L L L L
H	H	X	L	L L L L
X	X	H	H	H L L H
X	L	X	L	COUNT
L	X	L	X	COUNT
L	X	X	L	COUNT
X	L	L	X	COUNT

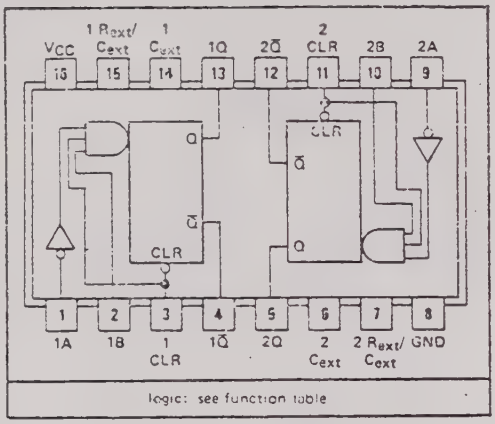
NOTES:
1. Output Q_A connected to input $\overline{CP}_{BD}$ for BCD count.
2. X indicates that either a HIGH level or a LOW level may be present.

The SN7490 is a TTL/MSI decade counter which consists of 4 dual master/slave flip-flops internally interconnected to provide ÷2 and ÷5 counting. Count inputs are inhibited, and all outputs are returned to logical zero or a binary coded decimal (BCD) count of 9 through gated direct reset lines. The output from flip-flop A is not internally connected to the succeeding stages, therefore the count may be separated into these independent count modes.

If used as binary coded decimal decade counter, the $\overline{CP}_{BD}$ input must be externally connected to the Q_A output. The $\overline{CP}_A$ input receives the incoming count, and a count sequence is obtained in accordance with the BCD count for nine's complement decimal application.

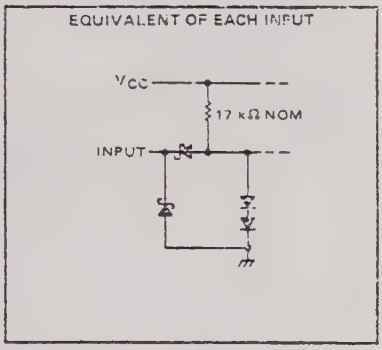
If a symmetrical divide-by-ten count is desired for frequency synthesizers or other applications requiring division of a binary count by a power of ten the Q_D output must be externally connected to the $\overline{CP}_A$ input. The input count is then applied at the $\overline{CP}_{BD}$ input & a divide-by-ten squarewave is obtained at output Q_A.

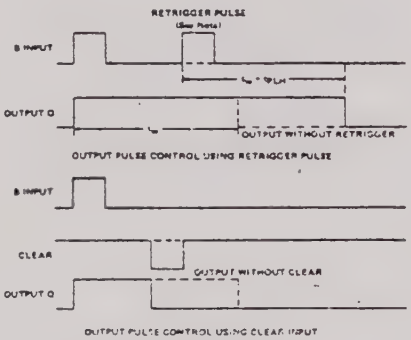
For operation as a divide-by-two counter and a divide-by-five counter, no external interconnections are required. Flip-flop A is used as a binary element for the divide-by-two function. The $\overline{CP}_{BD}$ input is used to obtain binary divide-by-five operation at the Q_B, Q_C and Q_D outputs. In this mode, the 2 counters operate independently; however, all 4 flip-flops are reset simultaneously.



logic: see function table

schematics of inputs and outputs





NOTE: Retrigger pulse must not start before 0.22 C_{ext} (in picofarads) nanoseconds after previous trigger pulse.

FIGURE 1–TYPICAL INPUT/OUTPUT PULSES

TYPICAL OUTPUT PULSE WIDTH
vs
EXTERNAL TIMING CAPACITANCE

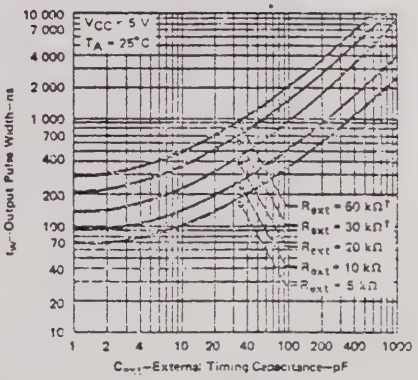


FIGURE 2

† These values of resistance exceed the maximum recommended for use over the full temperature range of the SN54LS' circuits.

These monostables are designed to provide the system designer with complete flexibility in controlling the pulse width, either to lengthen the pulse by retriggering, or to shorten by clearing. The 'LS122 has an internal timing resistor which allows the circuit to be operated with only an external capacitor, if so desired.

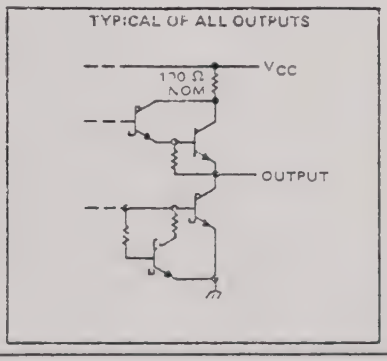
The output pulse is primarily a function of the external capacitor and resistor. For $C_{ext} > 1000$ pF, the output pulse width (t_w) is defined as:

$$t_w = 0.4 \cdot R_T \cdot C_{ext}$$

where

R_T is in kΩ (either internal or external timing resistor),
C_{ext} is in pF,
t_w is in ns.

For pulse widths when $C_{ext} \leq 1000$ pF, see Figure 2.



SN54LS196 and SN74LS196

The output of flip-flop A is not internally connected to the succeeding flip-flops; therefore, the count may be operated in three independent modes:

1. When used as a binary-coded-decimal decade counter, the clock-2 input must be externally connected to the Q_A output. The clock-1 input receives the incoming count, and a count sequence is obtained in accordance with the BCD count sequence function table shown at the right.

2. If a symmetrical divide-by-ten count is desired for frequency synthesizers (or other applications requiring division of a binary count by a power of ten), the Q_D output must be externally connected to the clock-1 input. The input count is then applied at the clock-2 input and a divide-by-ten square wave is obtained at output Q_A in accordance with the bi-quinary function table.

SN54LS196, SN74LS196
FUNCTION TABLES

DECADE (BCD)
(See Note A)

COUNT	OUTPUTS			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H

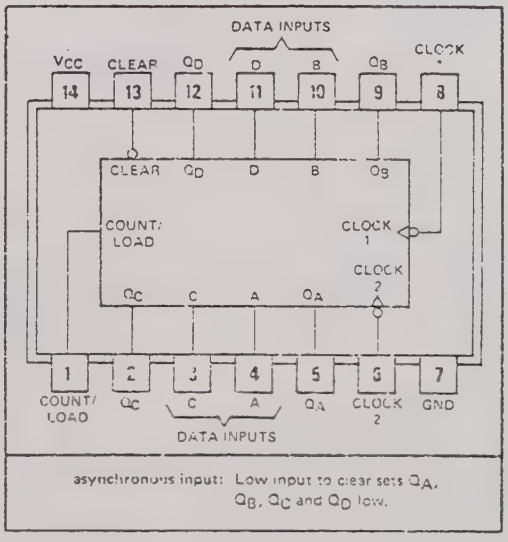
BI-QUINARY (5-2)
(See Note B)

COUNT	OUTPUTS			
	Q_A	Q_D	Q_C	Q_B
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	H	L	L	L
6	H	L	L	H
7	H	L	H	L
8	H	L	H	H
9	H	H	L	L

H = high level, L = low level

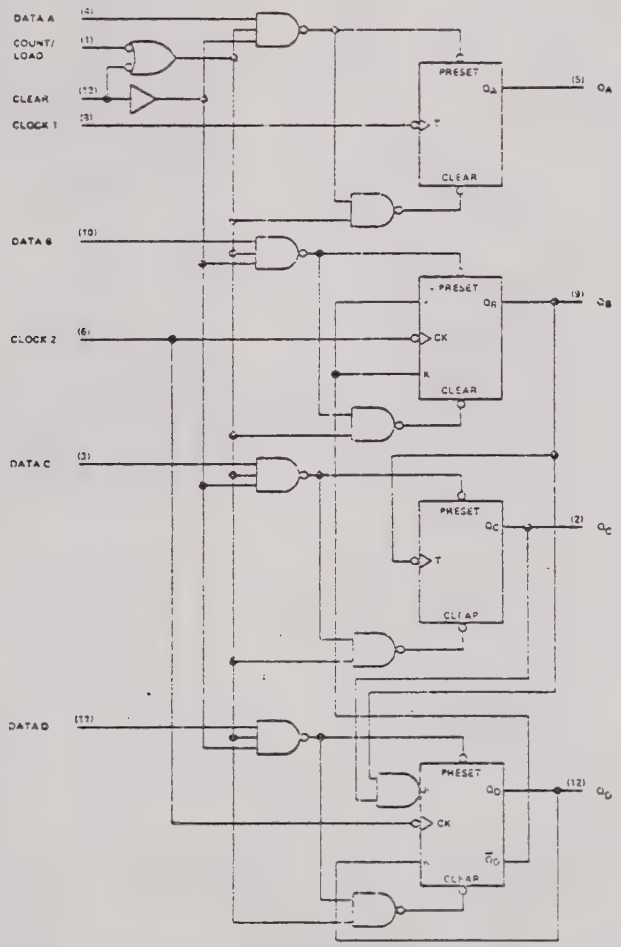
NOTES: A. Output Q_A connected to clock-2 input.
B. Output Q_D connected to clock-1 input.

3. For operation as a divide-by-two counter and a divide-by-five counter, no external interconnections are required. Flip-flop A is used as a binary element for the divide-by-two function. The clock-2 input is used to obtain binary divide-by-five operation at the Q_B, Q_C, and Q_D outputs. In this mode, the two counters operate independently; however, all four flip-flops are loaded and cleared simultaneously.

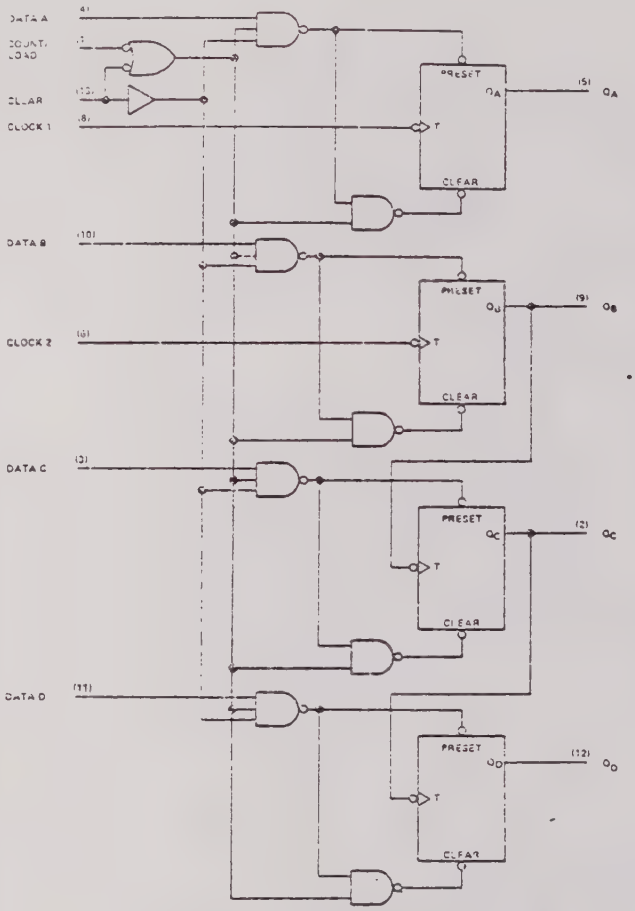


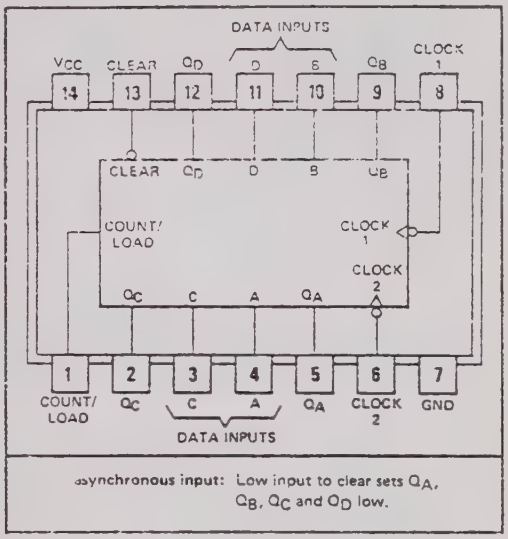
asynchronous input: Low input to clear sets Q_A, Q_B, Q_C and Q_D low.

SN54LS196, SN74LS196



. . . . Dynamic input activated by a transition from a high level to a low level





Asynchronous input: Low input to clear sets Q_A, Q_B, Q_C and Q_D low.

SN54LS197 and SN74LS197

The output of flip-flop A is not internally connected to the succeeding flip-flops, therefore the counter may be operated in two independent modes:

1. When used as a high-speed 4-bit ripple-through counter, output Q_A must be externally connected to the clock-2 input. The input count pulses are applied to the clock-1 input. Simultaneous divisions by 2, 4, 8, and 16 are performed at the Q_A, Q_B, Q_C, Q_D output as shown in the function table at right.

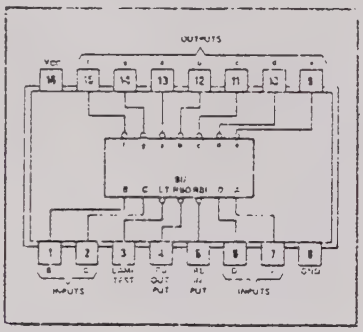
2. When used as a 3-bit ripple-through counter, the input count pulses are applied to the clock-2 input. Simultaneous frequency divisions by 2, 4, and 8 are available at the Q_B, Q_C, and Q_D outputs. Independent use of flip-flop A is available if the load and clear functions coincide with those of the 3-bit ripple-through counter.

SN54LS197, SN74LS197
FUNCTION TABLE
(See Note A)

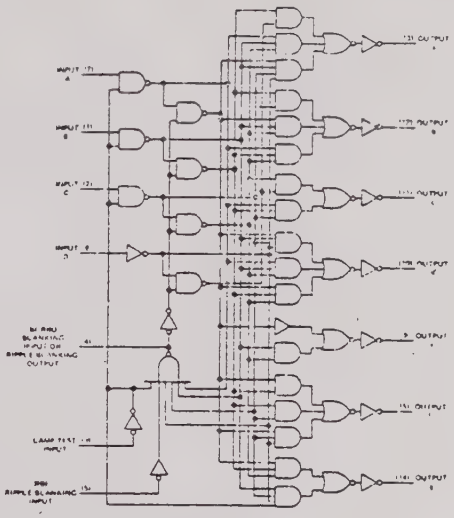
COUNT	OUTPUTS			
	Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

H = high level, L = low level
NOTE A. Output Q_A connected to clock-2 input.

'246, '247, 'LS247



'246, '247, 'LS247



SEGMENT IDENTIFICATION

NUMERICAL DESIGNATIONS AND RESULTANT DISPLAYS

FUNCTION TABLE

DECIMAL OR FUNCTION	INPUTS						BI/RBO†	OUTPUTS							NOTE
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF	1
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF	
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON	
3	H	X	L	L	H	H	H	ON	ON	ON	ON	OFF	OFF	ON	
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	OFF	ON	ON	
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON	
6	H	X	L	H	H	L	H	ON	OFF	ON	ON	ON	ON	ON	
7	H	X	L	H	H	H	H	ON	ON	ON	OFF	OFF	OFF	OFF	
8	H	X	H	L	L	L	H	ON	ON	ON	ON	ON	ON	ON	
9	H	X	H	L	L	H	H	ON	ON	ON	ON	OFF	ON	ON	
10	H	X	H	L	H	L	H	OFF	OFF	OFF	ON	ON	OFF	ON	
11	H	X	H	L	H	H	H	OFF	OFF	ON	ON	OFF	OFF	ON	
12	H	X	H	H	L	L	H	OFF	ON	OFF	OFF	OFF	ON	ON	
13	H	X	H	H	L	H	H	ON	OFF	OFF	ON	OFF	ON	ON	
14	H	X	H	H	H	L	H	OFF	OFF	OFF	ON	ON	ON	ON	
15	H	X	H	H	H	H	H	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
BI	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
RBI	H	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
LT	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	ON	4

H = high level, L = low level, X = irrelevant

NOTES: 1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.

2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are off regardless of the level of any other input.

3. When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output (RBO) goes to a low level (response condition).

4. When the blanking input/ripple blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

†BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

CHAPTER 6

REPLACEABLE PARTS

6.1 INTRODUCTION

This chapter contains the parts lists for each assembly in the Model 624XA Frequency Counter. Chapter 7 shows the assemblies where the listed parts are installed. Ordering information is included and should be used when purchasing parts from the factory. Explanation of the column listings and Table 6-1 Manufacturer's Code-To-Name Index are also included.

6.2 PART ORDERING INFORMATION

To order a part from the Replaceable Parts List, state the Systron-Donner part number, indicate the quantity required and address the order to the nearest Systron-Donner sales or service center.

To order a part not listed in the Replaceable Parts List, state the instrument model number, instrument serial number, the description and function of the part and the number of parts required. Address the order to the nearest Systron-Donner Sales or Service Center.

6.3 PARTS LISTS

The replaceable parts lists are placed in A numbered sequence.

Each column in the parts lists provide specific information relating to the listed parts as follows:

(1) DESIGNATOR: Reference numbers applicable to assemblies are listed in alpha-numeric order.

(2) COMPONENT NOMENCLATURE AND DESCRIPTION: Component names and specifications are provided in these columns and include value, tolerance, wattage rating, working voltage, construction, etc.

(3) MANUFACTURER'S CODE: H4-2 Federal Supply Code numbers are listed to identify component manufacturers. A Manufacturers Index is provided in this chapter for cross-reference.

(4) MANUFACTURER'S PART NUMBER: True manufacturer part numbers are lsited in this column.

(5) SD STOCK NUMBER: The Systron-Donner stock number is listed in this column.

(6) T/Q (Total Quantity): This quantity, appearing after an item entry, indicates the number of times the component is used in that assembly. The total quantity for each part is given only once - at the first appearance of the part number in the list.

TABLE 6-1 MANUFACTURER'S CODE-TO-NAME INDEX

CODE	NAME & ADDRESS
00779	Amp. Inc. . P.O. Box 3608 Harrisburg, PA 17105
01121	Allen Bradley Co. 1201 S. 2nd Street Milwaukee, WI 53204
01295	Texas Instruments Inc. Semiconductor & Components Div. 13500 North Central Expressway Dallas, TX 75231
02660	Amphenol Corp. 2801 S. 25th Ave. Broadview, IL 60153
07263	RCA Corp. Solid State Div. Route 202, Somerville, NJ 08876
02763	Grippe Machining & Mfg. Co. 15642 Common Rd. Roceville, MI 48066
03508	General Electric Company Semiconductor Products Dept. Electronics Park, Syracuse, NY 13201
04713	Motorola Semiconductor Prod. Div. 5005 East McDowell Road Phoenix, AZ 85008
05245	Components Corp. 2857 N. Halsted St. Shicago, IL 60657
06383	Panduit Corp. 17301 Ridgeland Tinley Park, IL 60477
06540	Amatom Electronic Hardware Division of Mite Corp. 81 Rockdale Ave. New Rochelle, NY 10806
06560	Airco Speer Electronics Division of Air Reduction Co. Inc. P.O. Box 1692, Grand Plaza 945 Grand Ave. Nogales, AZ 85621
07263	Fairchild Camera & Instrument Corp. Semiconductor Division 313 Frontage Rd. Mountain View, CA 94040
07933	Raytheon Co. Semiconductor Division HQ 350 Ellis St. Mountain View, CA 94040
09353	C & K Components Inc. 103 Morse, Newton, MA 02158
14099	Semtech Corp. 652 Mitchell Rd. Newbury Park, CA 91320
12014	Chicago Rivet & Machine Co. 950 So. 25th Ave. Bellwood, IL 60104
16179	Omni Spectra Inc. 24600 Hallwood Ct. Farmington, MI 48024
16733	Phelps Dodge Communciations Co. Div. of Phelps Dodge Cooper Corp. North Haven, CT 06473
18324	Signetics Corp. 811 E. Arques, Sunnyvale CA 94086
19701	Mepco/Electra Inc. Electra Division P.O. Box 760 Mineral Wells, TX 76067
21847	Aertech 825 Stewart Drive Sunnyvale, CA 94086
27014	National Semiconductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051
27018	Optimum Designs Inc. 152 W. 42nd Street New York, NY 10017
27264	Molex Products Co. 5224 Katrine Ave. Downers Grove, IL 60515

TABLE 6-1 MANUFACTURER'S CODE-TO-NAME INDEX (Cont'd)

CODE	NAME & ADDRESS
28480	Hewlett-Packard Co. . 1501 Page Mill Road Palo Alto, CA 94304
28520	Heyman Mfg. Co. 147 N. Michigan Ave Kenilworth, NJ 07033
29454	Monolithic Dielectrics Inc. P.O. Box 6465 2220 Screenland Drive Burbank, CA 91505
30146	A P Inc. 72 Corwin Dr. Plainesville OH 44077
32159	West-Cap Arizona 2201 E. Elvira Rd. Tucson, AZ 05706
34420	Verdyne Corp. 330 N. Victory Blvd Burbank, CA 91502
44655	Ohmite Mfg. Co. 3601 W. Howard St. Skokie, IL 60076
50522	Monsanto Co. Electronic Special Products 10131 Bubb Rd. Cupertino, CA 95014
52542	Systron-Donner Corp. Instrument Division 10 Systron Drive Concord, CA 94518
52648	Plessey Semiconductor 1674 McGaw Ave. Santa Ana, CA 92705
56289	Sprague Electronic Co. North Adams, MA 01247
59730	The Thomas & Betts Co. 36 Butler St. Elizabeth, NJ 07207
70903	Belden Crop. 415 So. Kilpatrick Chicago, IL 60644
71279	Cambridge Thermonic Corp. 445 Concord Ave. Cambridge, MA 01238
71400	Bussmann Mfg. Division of McGraw-Edison Co. 2536 W. University St. St. Louis, MO 63017
71590	Globe-Union Inc. Centralab Electronics Division 5757 No. Green Bay Ave. Milwaukee, WI 53201
71785	TRW Electronic Components Cinch Connector Operations 1501 MOrse Ave. Elk Grove Village, IL 60007
72136	Electro Motive Mfg. Co. Inc. South Park & John Sts. Willimantic, CO 06226
72259	Nytronics Inc. 10 Pelham Parkway Pelham Mannor, NY 10803
72982	Erie Technological Products Inc. 644 W. 12th St., Erie, PA 16512
73138	Beckman Instruments Inc. Helipot Division 2500 Harbor Blvd. Fullerton, CA
73803	Texas Instruments Inc. Metallurigical Materials Division Attleboro, MA 02703
74970	E. F. Johnson Co. 299 10th Ave. S.W. Waseco, MN 56093
75915	Littlefuse Inc. 800 E. Northwest Hwy. Des Plaines, IL 60016
77969	Rubbercraft Corp. of Calif. Ltd. 1800 W. 220th Street Torrance, CA 90507
76381	Minnesota Mining & Mfg. Co. 3 M Center, St. Paul, MN 55101

TABLE 6-1 MANUFACTURER'S CODE-TO-NAME INDEX (Cont'd)

CODE	NAME & ADDRESS
78189	Illinois Tool Works Inc. Shakeproof Division St. Charles Road Elgin, IL 60120
78553	Tinnerman Products Inc. 8700 Brookpark Road Cleveland, OH 44129
79963	Zierick Mfg. Co. Radio Circle Mt. Kisco, NY 10549
80294	Bourns Inc. Instrument Division 6135 Magnolia Avenue Riverside, CA 92506
81073	Grayhill Inc. 561 Hillgrove Avenue La Grange, IL 60525
81349	MIL STD
81483	International Rectifier Corp. 9220 Sunset Blvd. Los Angeles, CA 90069
83330	Herman H. Smith Inc. 812 Snediker Avenue Brooklyn, NY 11207
86445	Pen Fibre & Specialty Co. 2032 E. Westmoreland Street Philadelphia, PA 19134
86797	Rogan Corp. 3455 Woodhead Drive Northbrook, IL 60062
86928	Seastrom Mfg. Co. Inc. 701 Sonora Avenue Glendale, CA 91201

NAME	NAME & ADDRESS
88245	Litton Systems Inc. 13536 Saticoy Street Van Nuys, CA 91409
90201	Mallory Capacitor Co. P.O. Box 372 3029 E. Washington Street Indianapolis, IN 46206
91418	Radio Materials Co. 4242 W. Bryn Mawr Chicago, IL 60646
91637	Dale Electronics Inc. P.O. Box 609 Columbus, NE 68601
91836	Kings Electronics Co. Inc. 40 Marbledale Road Tuckahoe, NY 10707
95987	Weckesser Co. Inc. 4444 W. Irving Park Road Chicago, IL 60641
96733	San Fernando Electric Mfg. Co. 1509 First Street San Fernando, CA 91341
96906	MIL STD
98921	O and M Mfg. Co. 8203 Market St. Road Houston, TX 77029
98978	International Electronic Research Corp. 135 W. Magnolia Avenue Burbank, CA 91502
99392	S T M Corp. 2904 Chapman Street Oakland, CA 94601

REPLACEABLE PARTS LIST

TITLE	FINAL ASSEMBLY MODEL 6241A #057641 Rev B; MODEL 6242A #057642 Rev B; MODEL 6243A #057643 Rev B and MODEL 6244A #057644 Rev B				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		ASSEMBLY, Test (Model 6241A)	52542	057581	057581	1
		ASSEMBLY, Test (Model 6242A)	52542	057582	057582	1
		ASSEMBLY, Test (Model 6243A)	52542	057583	057583	1
		ASSEMBLY, Test (Model 6244A)	52542	057584	057584	1
		PANEL, Decorative (Model 6241A)	52542	057637	057637	1
		PANEL, Decorative (Model 6242A)	52542	067638	057638	1
		PANEL, Decorative (Model 6243A)	52542	067639	067639	1
		PANEL, Decorative (Model 6244A)	52542	067640	067640	1
		COVER, Top	52542	057360	057260	1
		COVER, Bottom	52542	057261	057261	1
		CORD, Line	70903	BE-1736	102407	1
		FOOT	52542	057064	057064	4
		BUMPER	77969	4460	103880	4
		BAIL	52542	057132	057132	1
		KNOB	07933	50-2WD-1G	102764	1
		SCREW, PHMS 6-32 x 1/2	96906	MS51957-30	10063208	2
		SCREW, PHMS 6-32 x 1-3/4	96906	MS51957-37	10063228	4
		SCREW, PHMS 6-32 x 5/8	96906	MS52957-18	10063210	4
		NUT, Hex 6-32	96906	NAS671C6	100638	4
		WASHER, Internal Tooth #6	96906	MS35333–71	100647	6
		ASSEMBLY, Option 06 Battery Pack	52542	057862	057862	A/R
		ASSEMBLY, Option 08 TCXO Oscillator	52542	057666	057666	A/R
		ASSEMBLY, Option 09 TCXO Oscillator	52542	057667	057667	A/R
		ASSEMBLY, Option 10 Oven Oscillator	52542	057856	057856	A/R
		ASSEMBLY, Option 11 High Stability Oscillator	52542	067871	067871	A/R
		ASSEMBLY, Option 12 High Stability Oscillator	52542	067872	067872	A/R
		ASSEMBLY, Option 13 High Stability Oscillator	52542	067465	067465	A/R
		ASSEMBLY, Option 35 Parallel BCD	52542	057964	057964	A/R
		ASSEMBLY, Option 45 Multiplier	52542	057665	057665	A/R

REPLACEABLE PARTS LIST

TITLE	TEST ASSEMBLY MODEL 6241A #057581 Rev A (Figure 7-1)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Universal Chassis	52542	057575	057575	1
2	A3	ASSEMBLY, 10 MHz Osc PC	52542	05708801	05708801	1
5	W3	JUMPER	55210	L-2007-1	102879	1
8		WASHER, Flat #6	86928	5710-23-10	100662	2
9		WASHER, Split-Lock #6	96906	MS35338-136	100712	2
11		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	2

REPLACEABLE PARTS LIST

TITLE: TEST ASSEMBLY MODEL 6242A #057582 Rev B (Figure 7-2)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Universal Chassis	52542	057575	057575	1
2	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
3	A4	ASSEMBLY, 512 MHz Prescaler PC	52542	05706301	05706301	A/R
8		WASHER, Flat #6	86928	5710-23-10	100662	2
9		WASHER, Split-Lock #6	96906	MS35338-136	100712	4
11		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	4
12	W1,W3	JUMPER	55210	L-2007-1	102879	2
13	J2	CONNECTOR, BNC Fused	16733	CD701938-002	117080	1
	J2F1	FUSE, 1/8 A P/O J2	75915	275-125	100606	1

REPLACEABLE PARTS LIST

TITLE		TEST ASSEMBLY MODEL 6243A #057583 Rev B_1 (Figure 7-3)				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Universal Chassis	52542	057575	057575	1
2	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
4	A4	ASSEMBLY, 1.25 GHz Prescaler PC	52542	06725901	06725901	A/R
8		WASHER, Flat #6	86928	5710-23-10	100662	2
9		WASHER, Split-Lock #6	96906	MS35338-136	100712	4
11		SCREW, PHMS 6-32 x 5/16	96906	MS51957-37	10063205	4
12	W2,W3	JUMPER	55210	L-2007-1	102879	2
13	J2	CONNECTOR, BNC Fused	16733	CD01938-002	117080	1
	J2F1	FUSE, 1/8 A P/O J2	75915	275-125	100606	1

REPLACEABLE PARTS LIST

TITLE	TEST ASSEMBLY MODEL 6244A #057584 Rev D (Figure 7-4)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Universal Chassis	52542	057575	057575	1
2	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
3	A4	ASSEMBLY, 512 MHz Prescaler PC	52542	05706301	05706301	A/R
5	A5	ASSEMBLY, N Computer PC	52542	05757301	05757301	1
6	A6	ASSEMBLY, ACTO PC	52542	05752001	05752001	1
7		ASSEMBLY, ACTO Semi-Rigid Coax	52542	057974	057974	1
8		ASSEMBLY, Dual Sampler P/O A6	52542	057766	057766	1
9		ATTENUATOR, Pin	28480	33102A	103203	1
10		ASSEMBLY, Semi-Rigid Coax	52542	055212	055212	1
11	J2	CONNECTOR, BNC Fused	16733	CD01938-002	117080	1
12	J3	CONNECTOR, N to SMA	16179	21011	101185	1
13		SCREW, PHMS 2-56 x 1/4	96906	MS51957-3	10062504	6
14		SCREW, FHMS 4-40 x 5/16	96906	MS24693-C3	10072005	4
15		SCREW, PHMS 6-32 x 5/16	96906	MS51957-37	10063205	8
16		WASHER, Flat #6	86928	5710-23-10	100662	2
17		WASHER, Split-Lock #6	96906	MS35338-136	100712	8
18		WASHER, Flat #2	96906	MS15795-802	100614	6
19		WASHER, Split-Lock #2	96906	MS35337-77	100661	6
22		NUT, Kep 4-40	78189	511-041800-00	100941	4
23	W1	JUMPER	55210	L-2007-1	102879	1
	J2F1	FUSE, 1/8 A P/O J2	75915	275-125	100606	1
24		ASSEMBLY, Lock Logic P/O A6	52542	05791101	05791101	1
25	U29	INTEGRATED CIRCUIT Voltage Regulator	04713	MC78L15ACP	117260	1
26	C11,C12	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	2
27	C10	CAPACITOR, El Can 1500 μF, 50V	99392	23C50T5152	106468	1

REPLACEABLE PARTS LIST

TITLE 624XA UNIVERSAL CHASSIS ASSEMBLY #057575 Rev G_1 (Figure 7-5)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Logic PC	52542	05757001	05757001	1
2	A2	ASSEMBLY, Readout PC	52542	05756801	05756801	1
3	A1	ASSEMBLY, 100 MHz Amplifier PC	52542	05723801	05723801	1
4		PANEL, Rear	52542	057587	057587	1
5	PANEL	PANEL, Sub	52542	057645	057645	1
6		BRACKET, Transformer	52542	057110	057110	2
7	T1	TRANSFORMER	52542	057532	057532	1
8	q	PLATE, Cover	52542	057655	057655	1
9		BELL, End	52542	10367701	10367701	1
10	J4	RECEPTICAL, AC w/filter	05254	3EF1	102461	1
11	XF1	POST, Fuse	75915	342004	102409	1
12	F1	FUSE, Slo-Blo 1/2A	71400	MDL 1/2	100589	1
13	J5,J6	CONNECTOR, BNC	81349	UG-1094/U	101155	2
14	S2,S3	SWITCH, SPST	09353	7101	102310	2
15	S4	SWITCH, Pushbutton w/dress nut	81073	30-3 w/dress nut	102347	1
17		ASSEMBLY, Amp Input Cable	52542	057824	057824	1
19		SPACER, 3/16D x 5/16L	06540	9120B-115-3A	101026	2
20		LUG, BNC Ground	79963	814	107077	2
21		LUG, Solder #4	83330	1416-4	100509	1
22		SCREW, PHMS 8-32 x 1-1/2	96906	MS51957-51	10064224	4
23		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	6
24		SCREW, PHMS 4-40 x 1/2	96906	MS51957-17	10062608	2
25		SCREW, PHMS 4-40 x 5/16	96906	MS51957-14	10062605	3
26		SCREW, PHMS 2-56 x 5/8	96906	NAS662CR10	10070010	2
27		SCREW, PHMS 2-56 x 3/16	96906	MS51957-2	10062503	2
30		WASHER, Flat #8	86928	5702-225-30-C1	103014	2
31		WASHER, Flat #6	86928	5710-23-10	100662	4
32		WASHER, Split-Lock #6	96906	MS35338-136	100712	6
33		WASHER, Flat #4	96906	MS15795-803	100703	5
34		WASHER, Split-Lock #4	96906	MS35338-135	100711	4
35		WASHER, Split-Lock #2	96906	MS35337-77	100661	4
38		NUT, Hex 2-56	96906	MS35649-224	100636	2
39		NUT, Kep 8-32	78189	511-081800-00	100940	4
40		NUT, Hex 4-40	96906	NAS671C4	100622	5

REPLACEABLE PARTS LIST

TITLE	LOGIC PC ASSEMBLY #05757001 Rev H (Figure 7-6 & 7-7)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, Electrolytic 5000 μF, 15V	99392	23C15TS53	106459	2
	C2	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	6
	C3	Same as C1				
	C4	Same as C2				
	C5	CAPACITOR, Electrolytic 1500 μF, 50V	99392	23C50TS152	106468	1
	C6	Same as C2				
	C7	Same as C2				
	C8	Same as C2				
	C9	Same as C2				
	C10	Part of Option 10				
	C11	Part of Option 10				
	C12	Part of Option 10				
	C13	CAPACITOR, Tant 4.7 μF 10%, 10V	56289	150D475X9010A2	100205	2
	C14	CAPACITOR, Ceramic .01 μF +80-20%, 100V	91418	TA110	100103	3
	C15	CAPACITOR, Tant 2.2 μF 10%, 20V	56289	150D225X9020A2	100203	1
	C16	Same as C14				
	C17	CAPACITOR, DM 1000 pF 5%, 100V	72136	DM15FA102JO	100243	1
	C18	CAPACITOR, Ceramic .1 μF 20%, 50V	56289	5C023104X0500C5	100178	1
	C19	Same as C14				
	C20	CAPACITOR, Electrolytic 200 μF +100-10%, 35V	90201	MTV200DN35	100308	1
	C21	Same as C13				
	C22	Not Used				
	C23	Not Used				
	C24	Not Used				
	C25 thru C41	CAPACITOR, Ceramic .05 μF +80-20%, 10V	71590	UK10-503	100122	17
	CR1	DIODE, Rectifier 600V	04713	1N4005	100413	4
	CR2	Same as CR1				

TITLE	LOGIC PC ASSEMBLY #05757001 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	CR3	DIODE, Rectifier 50V	81483	30S05	103252	4
	CR4	Same as CR3				
	CR5	Same as CR3				
	CR6	Same as CR3				
	CR7	Same as CR1				
	CR8	Same as CR1				
	CR9	DIODE, Signal 50V	03508	1N4151	100385	2
	CR10	Same as CR9				
	J1	CONNECTOR, Dual 17-pin	30146	929836-01-17	117178	1
	Q1	TRANSISTOR, SINPN	27018	PN3646	101369	1
	Q2	TRANSISTOR, SINPN 15V	07263	PN4275-18	102716	1
	Q3	TRANSISTOR, SINPN	04713	MPSA12	101396	3
	Q4	Same as Q3				
	Q5	Same as Q3				
	Q6 thru Q13	TRANSISTOR, SIPNP 30V	04713	MPSA63	117349	8
	R1 thru R7	RESISTOR, Module 4 x 12k, 1/8W	52542	045008	045008	7
	R8	RESISTOR, CC 12 k 5%, 1/4W	01121	CB1235	101565	4
	R9	RESISTOR, CC 560 Ω 5%, 1/4W	01121	CB5615	101583	1
	R10	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	101570	2
	R11	Same as R8				
	R12	RESISTOR, CC 470 Ω 5%, 1/4W	01121	CB4715	101625	4
	R13	RESISTOR, CC 10 Ω 5%, 1/4W	01121	CB1005	101557	1
	R14	RESISTOR, CC 47 k 5%, 1/4W	01121	CB4735	101574	3
	R15	Same as R8				
	R16	RESISTOR, CC 22 k 5%, 1/4W	01121	CB2235	101572	2
	R17	Same as R16				
	R18	RESISTOR, CC 1 M 5%, 1/4W	01121	CB1055	101605	1

REPLACEABLE PARTS LIST

TITLE	LOGIC PC ASSEMBLY #05757001 (Cont'd)				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R19	RESISTOR, CC 150 Ω 5%, 1/4W	01121	CB1515	101615	3
	R20	RESISTOR, CC 10 M 5%, 1/4W	01121	CB1065	101564	1
	R21	Same as R8				
	R22	Same as R12				
	R23	Same as R10				
	R24	Same as R12				
	R25	Same as R12				
	R26 thru R33	RESISTOR, CC 33 k 5%, 1/4W	01121	CB3335	101576	8
	R34	Same as R14				
	R35	Same as R14				
	R36 thru R42	RESISTOR, CC 27 Ω 5%, 1/4W	01121	CB2705	101729	8
	R43	Same as R19				
	R44	Same as R36				
	R45	RESISTOR, CC 82 Ω 5%, 1/4W	01121	CB8205	101629	1
	R46	Same as R19				
	R47	RESISTOR, CC 1 k 5%, 1/4W	01121	CB1025	101569	2
	R48	Same as R47				
	S1	ASSEMBLY, Switch 10 position PB	52542	057572	057572	1
	U1	INTEGRATED CIRCUIT, TTL MSI Binary Counter/Latch	01295	SN74LS197N	103165	1
	U2	INTEGRATED CIRCUIT, CMOS Dual D Flip-Flop	04713	MC14013CP	103199	1
	U3	INTEGRATED CIRCUIT, CMOS Dual BCD Up Counter	04713	MC14518CP	103339	3
	U4	INTEGRATED CIRCUIT, ECL Quad 2-Input NOR Gate	04713	MC10100P	103712	1
	U5	INTEGRATED CIRCUIT, ECL MSI 2-5 Counter 100 MHz	04713	MC10138P	103837	1
	U6	INTEGRATED CIRCUIT, CMOS MUX Count Chain	52542	055095	055095	1
	U7	INTEGRATED CIRCUIT, TTL SSI Quad 2-Input NAND Gate	01295	SN74LS00N	103130	4

TITLE: LOGIC PC ASSEMBLY #05757001 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U8	INTEGRATED CIRCUIT, CMOS Hex Inverter	04713	MC14049CP	103217	1
	U9	Same as U3				
	U10	INTEGRATED CIRCUIT, ECL Dual D M-S Flip-Flop	04713	MC10131L	045239	1
	U11	INTEGRATED CIRCUIT, ECL Quad TTL/ECL Translator	04713	MC10124L	045228	1
	U12	INTEGRATED CIRCUIT, ECL Quad TTL/ECL Translator	04713	MC10125L	045226	2
	U13	INTEGRATED CIRCUIT, TTL MSI Decade Counter Latch	01295	SN74LS196N	103164	2
	U14	Same as U7				
	U15	Same as U3				
	U16	Same as U12				
	U17	Same as U7				
	U18	Same as U13				
	U19	INTEGRATED CIRCUIT, TTL SSI Quad 2-Input OR Gate	01295	SN74LS32N	103972	1
	U20	INTEGRATED CIRCUIT, CMOS Hex Buffer	04713	MC14050CP	103492	1
	U21	INTEGRATED CIRCUIT, TTL MSI 7-Segment Decoder/Driver	01295	SN74247N	103314	1
	U22	Same as U7				
	U23	INTEGRATED CIRCUIT, TTL MSI Decade Counter	01295	SN7490N	025732	1
	U24	INTEGRATED CIRCUIT, CMOS 8-Channel Data Selector	04713	MC14512CP	103942	1
	U25	INTEGRATED CIRCUIT, TTL SSI Quad 2-Input AND Gate	01295	SN74LS08N	103967	1
	U26	INTEGRATED CIRCUIT, TTL SSI Dual One Shot	01295	SN74LS123N	103976	1
	U27	INTEGRATED CIRCUIT, LIN MSD Wide Range Timer	18324	NE555V	045208	1
	U28	INTEGRATED CIRCUIT ROM Decimal Point and MU	52542	055998	055998	1
	U29	Part of Option 10				
	U30	INTEGRATED CIRCUIT Voltage Regulator -7.2V	04713	MC7902CP	103944	1
	U31	INTEGRATED CIRCUIT Voltage Regulator -5.2V	04713	MC7905.2CP	103033	1

REPLACEABLE PARTS LIST

TITLE	LOGIC PC ASSEMBLY #05757001 (Cont'd)				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U32	INTEGRATED CIRCUIT Voltage Regulator +5V	04713	MC7805CP	045256	1
	XA5	CONNECTOR, Dual 36-pin	30146	929975	117177	1
	XU6	SOCKET, 40-pin	73803	C83-40-02	117159	1
	XU30	SOCKET, 3-pin	27264	10-18-2031	117324	3
	XU31	Same as XU30				
	XU32	Same as XU30				
		JUMPER	55210	L-2007-1	102879	19
		TERMINAL	88245	2000B	100482	9
		SPACER, Swage 6 x 1/4 lg	71279	1247-11	100539	2
		SPACER, Swage 6-32 x 1/8 lg	88245	1530 B 1/8	100478	8
		SCREW, PHMS 2-56 x 1/4	96906	MS51957-3	10062504	2
		WASHER, Flat #2	96906	MS15795-802	100614	2
		WASHER, Split-Lock #2	96906	MS35337-77	100661	2
		NUT, Hex 2-56	96906	MS35649-224	100636	2
		CONNECTOR, PC Pin 90°	91662	60 5001 19 13	117036	2
		BOARD, PC	52542	057570	057570	1

REPLACEABLE PARTS LIST

TITLE	A1, 100 MHz AMPLIFIER PC ASSEMBLY #05723801 Rev K (Figure 7-8 & 7-9)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, Chip .1 μF, 500V	29454	501S48W104PPS	103755	1
	C2	CAPACITOR, DM 15 pF 5%, 500V	72136	DM15CD150JO	100241	1
	C3	CAPACITOR, Chip .056 μF 20%, 100V	32159	SC31BX563M	100257	1
	C4	CAPACITOR, Tant 4.7 μF 10%, 10V	56289	150D475X9010A2	100205	1
	C5	CAPACITOR, Tant 100 μF 20%, 10V	56289	150D107X9010R2	100119	4
	C6	CAPACITOR, Ceramic .1 μF 20%, 50V	56289	5C023104X0500C5	100178	1
	C7	CAPACITOR, Ceramic .05 μ +80-20%, 10V	71590	UK10-503	100122	9
	C8	Same as C5				
	C9	Factory Select				
	C10	Factory Select				
	C11	Factory Select				
	C12	Same as C5				
	C13	Same as C7				
	C14	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	2
	C15	Same as C14				
	C16	Same as C5				
	C17 thru C20	Same as C7				
	C21	CAPACITOR, Tant 39 μF 10%, 10V	56289	150D396X9010B2	100183	1
	C22 thru C24	Same as C7				
	CR1	DIODE, Signal 50V	03508	1N4151	100385	2
	CR2	Same as CR1				
	J1 thru J7	SOCKET, 1-pin	27264	02-05-7101	103869	7
	Q1	TRANSISTOR, MOSFET	04713	MFE121	101413	1
	Q2	TRANSISTOR, SIPNP	07263	PN3640	101357	1
	Q3	TRANSISTOR, SINPN	07263	PN3565	101371	1

REPLACEABLE PARTS LIST

TITLE	A1, 100 MHz AMPLIFIER PC ASSEMBLY #05723801 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R1	RESISTOR, CC 220 k 10%, 1/2W	01121	EB2241	610500	1
	R2	RESISTOR, CC 750 k 5%, 1/4W	01121	CB7545	101585	1
	R3	RESISTOR, CC 470 Ω 5%, 1/4W	01121	CB4715	101625	6
	R4	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	101570	2
	R5	RESISTOR, CC 220 Ω 5%, 1/4W	01121	CB2215	101566	1
	R6	RESISTOR, CC 1 k 5%, 1/4W	01121	CB1025	101569	4
	R7	RESISTOR, Variable 10 k 20%, 1/2W	80294	3329W-1-103	101937	1
	R8	Same as R4				
	R9	RESISTOR, CC 390 Ω 5%, 1/4W	01121	CB3915	101592	5
	R10	RESISTOR, CC 270 Ω 5%, 1/4W	01121	CB2715	101542	6
	R11	RESISTOR, CC 130 Ω 5%, 1/4W	01121	CB1315	101627	6
	R12	Same as R3				
	R13	Same as R9				
	R14	Same as R10				
	R15	Same as R11				
	R16	Same as R3				
	R17	Same as R9				
	R18	Same as R10				
	R19	Same as R11				
	R20	Same as R3				
	R21	Same as R9				
	R22	Same as R11				
	R23	Same as R10				
	R24	Same as R3				
	R25	Same as R9				
	R26	Same as R11				
	R27	Same as R10				
	R28	Same as R3				
	R29	Same as R6				

TITLE: A1, 100 MHz AMPLIFIER PC ASSEMBLY #05723801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R30	RESISTOR, CC 820 Ω 5%, 1/4W	01121	CB8215	101567	1
	R31	Same as R6				
	R32	RESISTOR, CC 150 Ω 5%, 1/4W	01121	CB1515	101615	1
	R33	Same as R10				
	R34	Same as R11				
	R35	Not Used				
	R36	Same as R6				
	U1	INTEGRATED CIRCUIT, ECL Triple Line Receiver	04713	MC10216L	045276	2
	U2	Same as U1				
	U3	INTEGRATED CIRCUIT Voltage Regulator	04713	MC79L05ACP	117014	1
		BRACKET, Right Angle	79963	176	100849	2
		SCREW, PHMS 6-32 x 1/4	96906	MS51957-26	10063204	2
		WASHER, Flat #6	86928	5710-23-10	100662	2
		WASHER, Split-Lock #6	96906	MS35338-136	100712	2
		BOARD, PC	52542	057238	057238	1

REPLACEABLE PARTS LIST

TITLE	A2, READOUT PC ASSEMBLY #05756801 Rev C (Figure 7-10 & 7-11)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	DS1 thru DS8	INDICATOR, 7-Segment	50522	MAN4610	10317201	8
	DS9	INDICATOR, LED Red	50522	5152	117845	2
	DS10	Same as DS9				
	XDS1 thru XDS8	SOCKET, PC 14-pin	73803	C83-14-02	117040	8
		CABLE, Ribbon	30146	922526-34-02-5	117176	1
		BOARD, PC	52542	057568	057568	1

REPLACEABLE PARTS LIST

TITLE	A3, 10 MHz OSCILLATOR PC ASSEMBLY #05708801 Rev A (Figure 7-12 & 7-13)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, Variable 9-35 pF	72982	538-006D9.0-35	100159	1
	C2	CAPACITOR, Variable 15-60 pF	72982	538-011F15-60	100234	1
	C3	CAPACITOR, Mica 150 pF 5%, 500V	72136	DM15PF	100219	1
	C4	CAPACITOR, Mica 100 pF 5%, 500V	72136	DM15FD101JO	10017301	1
	C5	CAPACITOR, DM 220 pF 5%, 500V	72136	DN15FD221JO	10022001	1
	C6	CAPACITOR, DM 33 pF 5%, 500V	72136	DN15ED330JO	10017501	1
	C7	CAPACITOR, DM 10 pF 5%, 500V	72136	DM15CD100JO	10025301	1
	C8	CAPACITOR, Ceramic .01 μF +80-20%, 100V	91418	TA110	100103	1
	C9	CAPACITOR, Ceramic .05 μF +80-20%, 10V	71590	UK10-503	100122	2
	C10	Same as C9				
	Q1	TRANSISTOR, SINPN	07263	PN4275	102716	3
	Q2	Same as Q1				
	Q3	Same as Q1				
	R1	RESISTOR, CC 33 k 5%, 1/4W	01121	CB3335	101576	1
	R2	RESISTOR, CC 82 k 5%, 1/4W	01121	CB8235	101578	1
	R3	RESISTOR, CC 4.7 k 5%, 1/4W	01121	CB4725	101598	1
	R4	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	101570	1
	R5	RESISTOR, CC 1 k 5%, 1/4W	01121	CB1025	101569	1
	R6	RESISTOR, CC 3.3 k 5%, 1/4W	01121	CB3325	101559	1
	R7	RESISTOR, CC 470 Ω 5%, 1/4W	01121	CB4715	101625	1
	Y1	CRYSTAL, 10 MHz	52542	039483	039483	1
		STANDOFF, Swage 6-32 x 1/8	88245	1530 B 1/8	100478	2
		BOARD, PC	52542	057088	057088	1

REPLACEABLE PARTS LIST

TITLE	A4, 512 MHz PRESCALER PC ASSEMBLY #05706301 (Figure 7-14) Rev H Models 6242A & 6244A					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1 thru C5	CAPACITOR, DP Ceramic .056 μF 20%, 100V	34420	200-100-X74563M	116619	24
	C6	CAPACITOR, DP Ceramic 15 pF 5%, 100V	96733	DB44BY150J	117624	7
	C7 thru C9	Same as C1				
	C10	Same as C6				
	C11	Same as C1				
	C12	CAPACITOR, Ceramic .05 μF +80-20%, 10V	71590	UK10-503	100122	1
	C13 thru C15	Same as C1				
	C16	Same as C6				
	C17	CAPACITOR, Ceramic 1 μF 20%, 50V	56289	5CZ5U105X0050C5	100176	2
	C18	Same as C1				
	C19	Same as C6				
	C20	Same as C1				
	C21	Same as C1				
	C22	CAPACITOR, Tant 4.7 μF 10%, 10V	56289	150D475X9010A2	100205	4
	C23	Same as C6				
	C24 thru C26	Same as C1				
	C27	Same as C6				
	C28	Same as C1				
	C29	Same as C22				
	C30	Not Used				
	C31	CAPACITOR, Ceramic .001 μF 20%, 50V	71590	CW15C102M	100251	1
	C32	Same as C22				
	C33	Same as C22				
	C34 thru C36	Same as C1				

TITLE A4, 512 MHz PRESCALER PC ASSEMBLY #05706301 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C37	Same as C17				
	C38	Same as C1				
	C39	Same as C1				
	C40	Same as C6				
	C41	CAPACITOR, Ceramic 4.7 pF 5%, 100V	51642	CN10A4R70	117358	1
	C42	CAPACITOR, Ceramic .1 μF 10%, 50V	32159	C5058X104K	100155	1
	CR1	DIODE, Signal	28480	5082-2810	103346	3
	CR2	DIODE, Pin	21847	A5S138	103197	2
	CR3	DIODE, Signal	28480	5082-2800	100442	2
	CR4	Same as CR3				
	CR5	DIODE, Detector	28480	A2X1619	100437	1
	CR6	Same as CR1				
	CR7	Same as CR1				
	J1 thru J6	SOCKET, 1-pin	27264	02-05-7101	103869	6
	L1 thru L6	INDUCTOR, Fixed 10 μH	72259	WEE-WEE-10	101317	6
	P1	ASSEMBLY, Input Cable	52542	067283	067283	1
	Q1	CONNECTOR, Cable Plug	52542	104239	104239	1
	Q1	TRANSISTOR, SINPN	04713	2N6304	103171	4
	Q2	TRANSISTOR, SINPN	04713	2N5835	101410	2
	Q3	Same as Q1				
	Q4	Same as Q2				
	Q5	Same as Q1				
	Q6	Same as Q1				
	Q7	TRANSISTOR, SIPNP	04713	2N3906	101378	1
	R1	RESISTOR, CC 68 Ω 5%, 1/4W	01121	CB6805	101690	1
	R2	RESISTOR, CC 22 Ω 5%, 1/4W	01121	CB2205	101696	6
	R3	RESISTOR, CC 56 Ω 5%, 1/8W	01121	BB5605	101816	7
	R4	Same as R2				
	R5	Same as R3				

REPLACEABLE PARTS LIST

TITLE	A4, 512 MHz PRESCALER PC ASSEMBLY #05706301 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R6	Same as R2				
	R7	Same as R3				
	R8	Same as R2				
	R9	Same as R3				
	R10	Same as R2				
	R11	Same as R3				
	R12	Same as R2				
	R13	Same as R3				
	R14	Same as R3				
	R15	RESISTOR, CC 470 Ω 5%, 1/4W	01121	CB4715	101625	1
	R16	RESISTOR, CC 100 k 5%, 1/4W	01121	CB1045	101558	1
	R17	RESISTOR, CC 4.7 k 5%, 1/4W	01121	CB4725	101598	1
	R18	RESISTOR, Variable 1 k 20%, 1/2W	80294	3329W-1-102	101893	1
	R19	RESISTOR, CC 5.1 k 5%, 1/4W	01121	CB5125	101541	1
	R20	RESISTOR, CC 1 k 5%, 1/4W	01121	CB1025	101569	2
	R21	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	101570	2
	R22	RESISTOR, CC 1.5 M 5%, 1/4W	01121	CB1555	101659	1
	R23	RESISTOR, CC 220 Ω 5%, 1/4W	01121	CB2215	101566	1
	R24	Same as R21				
	R25	Same as R20				
	R26	RESISTOR, CC 560 Ω 5%, 1/4W	01121	CB5615	101583	1
	R27	RESISTOR, CC 130 Ω 5%, 1/4W	01121	CB1315	101627	1
	R28	RESISTOR, CC 330 Ω 5%, 1/8W	01121	BB3315	101704	1
	TP1	FEEDTHRU, Teflon	98921	011-1007	100575	1
	U1	INTEGRATED CIRCUIT, ECL 1 GHz Decade Counter	04713	SC63001P1	103872	1

REPLACEABLE PARTS LIST

TITLE	A4, 512 MHz PRESCALER PC ASSEMBLY #05706301 (Cont'd)				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U2	INTEGRATED CIRCUIT, CMOS Voltage Comparator	01295	SN72311P	103943	1
		BRACKET, Right Angle	79963	176	100849	2
		SCREW, PHMS 6-32 x 1/4	96906	MS51957-26	10063204	2
		WASHER, Flat #6	86928	5710-23-10	100662	2
		WASHER, Split-Lock #6	96906	MS35338-136	100712	2
		WASHER, Mylar	86928	5622-9-7	100921	6
		BOARD, PC	52542	057063	057063	1

REPLACEABLE PARTS LIST

TITLE: A4, 1.25 GHz PRESCALER PC ASSEMBLY #06725901 Rev D 6243A Only (Figure 7-16 & 17)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1 thru C5	CAPACITOR, Chip .01 μF, 50V	34420	2BX050S103M	106509	27
	C6	CAPACITOR, Variable 1.5 pF	72982	513-002A 1-5 pF	103935	2
	C7	CAPACITOR, Chip 5.1 pF	32159	SC25BY5R10	100270	10
	C8	Same as C1				
	C9	Same as C1				
	C10	Same as C7				
	C11	Same as C1				
	C12	Same as C1				
	C13	Same as C7				
	C14	Same as C1				
	C15	Same as C1				
	C16	Same as C6				
	C17 thru C22	Same as C1				
	C23	Same as C7				
	C24	Same as C1				
	C25	Same as C1				
	C26	CAPACITOR, Tant 33 μF 25V	56289	196D336X0025LA3	106512	2
	C27	Same as C1				
	C28	CAPACITOR, Ceramic .05 μF +80-20%, 10V	71590	UK10-503	100122	2
	C29	Same as C28				
	C30	CAPACITOR, Tant 10 μF 10%, 20V	56289	150D106X9020B2	100063	1
	C31 thru C36	Same as C1				
	C37	Same as C7				
	C38	Same as C26				
	C39	CAPACITOR, Ceramic 1 μF 20%, 50V	56289	5C25U105X0050C5	100176	2
	C40 thru C44	Same as C7				
	C45	Same as C39				

REPLACEABLE PARTS LIST

TITLE: A4, 1.25 GHz PRESCALER PC ASSEMBLY #06725901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C46	Same as C1				
	C47	CAPACITOR, Ceramic .1 μF 20%, 50V	56289	5C023104X0500C5	100178	1
	CR1	DIODE, Det	28480	5082-2542	100437	2
	CR2	DIODE, Pin	21847	A5S138	103197	1
	CR3	DIODE, Signal	28480	5082-2800	100442	2
	CR4	Same as CR3				
	CR5	Same as CR1				
	J1 thru J6	SOCKET, 1-pin	27264	02-05-7101	103869	6
	L1 thru L6	INDUCTOR, Fixed 10 μH 10%	72259	WEE-WEE-10	101317	6
	P1	ASSEMBLY, Input Cable Prescaler	52542	067283	067283	1
	Q1 thru Q6	TRANSISTOR, SINPN	04713	BFR90	103948	6
	Q7	TRANSISTOR, SIPNP	04713	2N3906	101378	1
	R1	RESISTOR, CC 68 Ω 5%, 1/4W	01121	CB6805	101690	7
	R2	Same as R1				
	R3	Same as R1				
	R4	RESISTOR, Chip 22 Ω 5%	34420	IC220J	103998	7
	R5	Same as R1				
	R6	Same as R4				
	R7	Same as R1				
	R8	Same as R4				
	R9	Same as R1				
	R10	Same as R4				
	R11	Same as R1				
	R12	Same as R4				
	R13	RESISTOR, Variable 50 Ω 20%, 1/2W	73138	62PR50	101906	1
	R14	Same as R4				
	R15	RESISTOR, CC 560 Ω 5%, 1/4W	01121	CB5615	101583	1

REPLACEABLE PARTS LIST

TITLE	A4, 1.25 GHz PRESCALER PC ASSEMBLY #06725901 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R16	RESISTOR, CC 330 Ω 5%, 1/8W	01121	BB3315	101704	1
	R17	RESISTOR, CC 100 k 5%, 1/4W	01121	CB1045	101558	1
	R18	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	101570	2
	R19	Same as R4				
	R20	RESISTOR, CC 1 k 5%, 1/4W	01121	CH1025	101569	2
	R21	RESISTOR, CC 4.7 k 5%, 1/4W	01121	CB4725	101598	1
	R22	RESISTOR, Variable 1 k 20%, 1/2W	80294	3329W-1-102	101919	1
	R23	RESISTOR, CC 2 M 5%, 1/4W	01121	CB2055	101691	1
	R24	Same as R18				
	R25	Same as R20				
	R26	RESISTOR, Chip 50 Ω 1%	34420	2C500F	101991	1
	R27	RESISTOR, CC 5.1 k 5%, 1/4W	01121	CB5125	101541	1
	R28	RESISTOR, CC 560 Ω 5%, 1/8W	01121	BB5615	101710	2
	R29	Same as R28				
	R30	RESISTOR, CC 220 Ω 5%, 1/4W	01121	CB2215	101566	1
	R31	RESISTOR, CC 130 Ω 5%, 1/4W	01121	CB1315	101627	1
	R32	RESISTOR, CC 120 Ω 5%, 1/8W	01121	BB1215	101970	1
	TP1	TERMINAL	98921	001-1007	100575	1
	U1	INTEGRATED CIRCUIT, ECL High Speed Driver	52684	SP8617B	117476	1
	U2	INTEGRATED CIRCUIT, ECL MSI High Speed Driver	04713	SC63001P1	103872	1
	U3	INTEGRATED CIRCUIT Differential Voltage Comparator	01295	SN72311P	103943	1

TITLE A4, 1.25 GHz PRESCALER PC ASSEMBLY #06725901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		BRACKET, Mtg. Right Angle	79963	176	100849	2
		SCREW, PHMS 6-32 x 1/4	96906	MS51957-26	10063204	2
		WASHER, Flat #6	86928	5710-23-10	100662	2
		WASHER, Split-Lock #6	96906	MS35338-136	100712	2
		CONNECTOR, Cable Plug RF	98291	50-007-0000	104239	1
		BOARD, PC	52542	067259	067259	1

REPLACEABLE PARTS LIST

TITLE	A5, N COMPUTER PC ASSEMBLY #05757301 Rev E Model 6244A Only (Figure 7-18 & 7-19)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, DM 220 pF 5%, 500V	72136	DM15FD221JO	10022001	2
	C2	CAPACITOR, DM 33 pF 5%, 500V	72136	DM15ED330JO	10017601	2
	C3	CAPACITOR, DM 2000 pF 5%, 500V	72136	DM19FD202JO	100117	1
	C4	Same as C1				
	C5	Same as C2				
	C6	CAPACITOR, Ceramic .005 μF 20%, 500V	91418	SM250	100077	1
	C7	CAPACITOR, Ceramic .01 μF 20%, 50V	71590	UK50-103	117351	2
	C8	Same as C7				
	C9 thru C13	CAPACITOR, Ceramic .05 μF +80-20%, 10V	71590	UK10-503	100122	5
	CR1	DIODE, Signal	03508	1N4151	100385	2
	CR2	Same as CR1				
	P1	CONNECTOR, 72-pin	30146	929838-01-36	117179	1
	R1	RESISTOR, CC 220 k 5%, 1/4W	01121	CB2245	101610	2
	R2	RESISTOR, CC 680 k 5%, 1/4W	01121	CB6845	101675	1
	R3	Same as R1				
	R4	RESISTOR, CC 1.5 k 5%, 1/4W	01121	CB1525	101577	1
	R5	RESISTOR, CC 1 k 5%, 1/4W	01121	CB1025	101569	2
	R6	RESISTOR, CC 56 k 5%, 1/4W	01121	CB5635	101670	1
	R7	RESISTOR, CC 1 k 5%, 1/8W	01121	BB1025	101711	1
	R8	RESISTOR, CC 62 k 5%, 1/4W	01121	CB6235	101612	1
	R9	RESISTOR, CC 1.5 M 5%, 1/4W	01121	CB1555	101659	1
	R10	RESISTOR, CC 12 k 5%, 1/4W	01121	CB1235	101565	2
	R11	RESISTOR, CC 1.8 k 5%, 1/4W	01121	CB1825	101602	1

REPLACEABLE PARTS LIST

TITLE A5, N COMPUTER PC ASSEMBLY #05757301 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R12	RESISTOR, CC 120 k 5%, 1/4W	01121	CB1245	101580	1
	R13	Same as R5				
	R14	Same as R10				
	TP1	TERMINAL	98921	001-1007	100575	2
	TP2	Same as TP1				
	U1	INTEGRATED CIRCUIT, CMOS Programmable Binary Counter	04713	MC14526BCP	117144	2
	U2	INTEGRATED CIRCUIT, DMOS Dual 4-Bit Up Counter	04713	MC14520CP	117278	2
	U3	Same as U2				
	U4	INTEGRATED CIRCUIT, Linear Differential Voltage Comparator	01295	SN72311P	103943	2
	U5	INTEGRATED CIRCUIT, CMOS Quad 2-Input NAND Gate	04713	MC14011CP	103937	1
	U6	Same as U1				
	U7	INTEGRATED CIRCUIT, CMOS Dual D Flip-Flop	04713	MC14013CP	103199	1
	U8	INTEGRATED CIRCUIT Operational Amplifier	02735	CA3130T	103231	2
	U9	INTEGRATED CIRCUIT, CMOS Hex Inverter Buffer	02735	CD4049AE	103217	1
	U10	Same as U4				
	U11	Same as U8				
	U12	INTEGRATED CIRCUIT, CMOS Quad 2-Input AND Gate	04713	MC14081BCP	116101	1
	U13	INTEGRATED CIRCUIT, CMOS Dual Monostable Multiplier	04713	MC14528BCP	045289	1
		BRACKET	79963	176	100849	2
		SCREW, PHMS 6-32 x 1/4	96906	MS51957-26	10063204	2
		WASHER' Flat #6	86928	5710-23-10	100662	2
		WASHER, Split #6	96906	MS35338-136	100712	2
		BOARD, PC	52542	057573	057573	1

REPLACEABLE PARTS LIST

TITLE	A6, ACTO PC ASSEMBLY #05752001 Rev F 6244A Only (Figure 7-20 & 21)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, Ceramic 47 pF 5%, 100V	71590	CN15A470K	117359	1
	C2	CAPACITOR, Ceramic 4.7 pF 5%, 100V	71590	CN10A4R7D	117358	1
	C3	CAPACITOR, Mica 100 pF 5%, 500V	72136	DM15FD101JO	100173	2
	C4	CAPACITOR, Ceramic 6.8 k 5%, 1 kV	56289	10TCC-V68	106490	1
	C5	CAPACITOR, Ceramic 1000 pF 20%, 1 kV	91418	TYPE B	100076	12
	C6	CAPACITOR, Ceramic .05 μF +80-20%, 10V	71590	UK10-503	100122	5
	C7	Same as C5				
	C8	Same as C5				
	C9	CAPACITOR, Mica 56 pF 5%, 500V	72136	DM15ED560JO	100179	2
	C10	CAPACITOR, Mica 150 pF 5%, 500V	72136	DM15FD151JO	100219	1
	C11	CAPACITOR, Ceramic .033 μF 20%, 25V	71590	UK25-333	100333	1
	C12	CAPACITOR, Ceramic 1 μF 20%, 50V	56289	5CZU105X0050C5	100176	1
	C13	Same as C9				
	C14	Same as C3				
	C15	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	2
	C16	Same as C15				
	C17	Same as C5				
	C18	Same as C5				
	C19	Same as C5				
	C20	Same as C5				
	C21	CAPACITOR, Tant 100 μF 10%, 10V	56289	196D107X9010PA1	103714	3
	C22	Same as C6				
	C23	Same as C5				
	C24	Same as C5				
	C25	Same as C5				
	C26	CAPACITOR, Tant 1 μF 10%, 35V	56289	196D105X9035HA1	103716	1

REPLACEABLE PARTS LIST

TITLE	A6, ACTO PC ASSEMBLY #05752001 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C27	Same as C21				
	C28	Same as C6				
	C29	Same as C6				
	C30	Same as C5				
	C31	Same as C6				
	C32	Same as C21				
	C33	CAPACITOR, Ceramic .001 μF 20%, 50V	71590	CW150102M	100251	1
	C34	CAPACITOR, Ceramic .1 μF +80-20%, 10V	71590	UK10-104	100120	1
	C35	CAPACITOR, Ceramic .005 μF 20%, 500V	91418	SM250	100077	1
	C36	CAPACITOR, Ceramic Chip .056 μF 20%, 100V	32159	SC318X563M	100257	2
	C37	Same as C36				
	C38	CAPACITOR, Mica 10 pF 5%, 500V	72136	DM10CD100JO	100272	1
	C39	Same as C5				
	CR1	DIODE, Varicap 10-85 pF	04713	SMV1266	100453	1
	CR2	DIODE, Signal 50V	03508	1N4151	100385	4
	CR3	Same as CR2				
	CR4	Same as CR2				
	CR5	Same as CR2				
	L1	INDUCTOR, Wire Loop #22 GA				1
	L2	INDUCTOR, Fixed 15 μH 10%	72259	WEE-15	102670	2
	L3	INDUCTOR, Fixed .15 μH 10%	72259	DD-0.15	101311	2
	L4	INDUCTOR, Fixed 470 μH 5%	72259	WEE-470	101297	2
	L5	Same as L2				
	L6	Same as L3				
	L7	Same as L4				
	Q1	TRANSISTOR, SINPN	04713	2N3009	103388	2
	Q2	Same as Q1				
	Q3	TRANSISTOR, SINPN	04713	MPSA12	101396	2
	Q4	Same as Q3				
	R1	RESISTOR, CC 47 Ω 5%, 1/4W	01121	BB4705	101707	3
	R2	RESISTOR, CC 130 Ω 5%, 1/8W	01121	BB1315	101914	1

REPLACEABLE PARTS LIST

TITLE: A6, ACTO PC ASSEMBLY #05752001 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R3	RESISTOR, CC 82 Ω 5%, 1/8W	01121	BB8205	101800	5
	R4	RESISTOR, CC 100 Ω 5%, 1/4W	01121	CB1015	101609	5
	R5	RESISTOR, CC 330 Ω 5%, 1/4W	01121	CB3315	101536	9
	R6	Same as R5				
	R7	RESISTOR, CC 470 Ω 5%, 1/4W	01121	CB4715	101625	7
	R8	Same as R5				
	R9 thru R12	Same as R7				
	R13	Same as R5				
	R14	RESISTOR, CC 33 Ω 5%, 1/4W	01121	CB3305	101731	2
	R15	RESISTOR, CC 4.7 Ω 5%, 1/4W	01121	CB4705	101796	1
	R16	RESISTOR, CC 27 Ω 5%, 1/8W	01121	BB2705	101810	1
	R17	RESISTOR, CC 1 k 5%, 1/8W	01121	BB1025	101711	3
	R18	RESISTOR, CC 27 k 5%, 1/4W	01121	CB2735	101587	1
	R19	RESISTOR, Variable 20 k 10%, 1/4W	73138	66WR20K	102161	1
	R20	RESISTOR, CC 47 k 5%, 1/4W	01121	CB4735	101574	1
	R21	RESISTOR, CC 2.2 k 5%, 1/4W	01121	CB2225	101562	1
	R22	RESISTOR, CC 10 k 5%, 1/8W	01121	BB1035	101697	2
	R23	RESISTOR, CC 3.9 k 5%, 1/8W	01121	BB3925	101714	1
	R24	Same as R22				
	R25	RESISTOR, CC 6.8 k 5%, 1/8W	01121	BB6825	101716	1
	R26	RESISTOR, CC 680 Ω 5%, 1/8W	01121	BB6815	101972	1
	R27	RESISTOR, CC 120 k 5%, 1/4W	01121	CB1245	101580	1

REPLACEABLE PARTS LIST

TITLE	A6, ACTO PC ASSEMBLY #05752001 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R28	RESISTOR, CC 110 k 5%, 1/8W	01121	BB1145	101617	1
	R29	RESISTOR, CC 120 k 5%, 1/8W	01121	BB1245	101825	1
	R30	Same as R17				
	R31	RESISTOR, CC 150 k 5%, 1/8W	01121	BB1545	101826	1
	R32	RESISTOR, CC 100 k 5%, 1/8W	01121	BB1045	101976	1
	R33	RESISTOR, Variable 10 k 20%, 1/2W	80294	3329H-1-103	101916	2
	R34	RESISTOR, CC 4.7 k 5%, 1/4W	01121	CB4725	101598	2
	R35	Same as R33				
	R36	Same as R34				
	R37	RESISTOR, CC 1.5 k 5%, 1/4W	01121	CB1525	101577	2
	R38	Same as R37				
	R39	Same as R5				
	R40	Same as R5				
	R41	Same as R4				
	R42	Same as R4				
	R43	Same as R5				
	R44	Same as R5				
	R45	Same as R4				
	R46	Same as R4				
	R47	Same as R7				
	R48	Same as R7				
	R49	Same as R5				
	R50	RESISTOR, CC 4.7 Ω 5%, 1/8W	01121	BB47G5	106058	1
	R51	Same as R14				
	R52	Same as R3				
	R53	RESISTOR, CC 1.5 k 5%, 1/8W	01121	BB1525	101974	1
	R54	RESISTOR, CC 150 k 5%, 1/8W	01121	BB1545	101826	1
	R55	RESISTOR, CC 2.2 k 5%, 1/8W	01121	BB2225	101719	1

REPLACEABLE PARTS LIST

TITLE	A6, ACTO PC ASSEMBLY #05752001 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R56	Same as R3				
	R57	Same as R17				
	R58	RESISTOR, CC 27 k 5%, 1/8W	01121	BB2735	101952	1
	R59	RESISTOR, Variable 1 k 20%, 1/2W	80294	3329H-1-102	101919	1
	R60	RESISTOR, CC 56 k 5%, 1/8W	01121	BB5635	101823	1
	R61	RESISTOR, CC 8.2 k 5%, 1/8W	01121	BB8225	101799	1
	R62	RESISTOR, CC 220 Ω 5%, 1/8W	01121	BB2215	101798	5
	R63	Same as R1				
	R64	Same as R62				
	R65	Same as R1				
	R66	Same as R3				
	R67	Same as R62				
	R68	Same s R62				
	R69	RESISTOR, Variable 200 Ω 20%, 1/2W	80294	3329H-1-201	101921	1
	R70	Same as R62				
	R71	Same as R3				
	R72	RESISTOR, CC 4.7 k 5%, 1/8W	01121	BB4725	101792	1
	TP1	TERMINAL	98921	001-1007	100575	3
	TP2	Same as TP1				
	TP3	Same as TP1				
	U1	INTEGRATED CIRCUIT, ECL Triple Line Receiver	04713	MC10216L	045276	2
	U2	INTEGRATED CIRCUIT, ECL Dual D M-S Flip-Flop	04713	MC10231L	045227	1
	U3	INTEGRATED CIRCUIT, ECL 3 Expanded OR/NOR Gate	04713	MC10107P	103179	1
	U4	Same as U1				
	U5	INTEGRATED CIRCUIT Operational Amplifier	02735	CA3130T	103231	2
	U6	Same as U5				
	U7	INTEGRATED CIRCUIT Differential Voltage Comparator	01295	SN72311P	103943	1

REPLACEABLE PARTS LIST

TITLE	A6, ACTO PC ASSEMBLY #05752001 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U8	INTEGRATED CIRCUIT Operational Amplifier	27014	LM201AH	025758	1
		DUAL SAMPLER, Module	52542	057766	057766	1
		RECEPTACLE		75302-001	117354	8
		CONNECTOR	BERG	65781-040	117357	1
		BRACKET	79963	176	100849	2
		SOCKET, 1-pin	27264	02-05-7101	103869	7
		SCREW, PHMS 6-32 x 1/4	96906	MS51957-26	10063204	2
		WASHER, Flat #6	86928	5710-23-10	100662	2
		WASHER, Split-Lock #6	96906	MS35338-136	100712	2
		JUMPER	55210	L-2007-1	102879	1
		WASHER, Flat #4	96906	NAS620-42	100683	1
		WASHER, Split-Lock #4	96906	MS35338-135	100711	1
		TIE, Cable	06383	SSTIM	100753	1
		SPACER, 4-40 x 7/16	06540	9536B-A-0440-17	101062	1
	A6A1	ASSEMBLY, Lock Logic PC	52542	05791101	05791101	1
	P1	CONNECTOR, PC Pin (Male Post)	00779	86090-4	100565	1
		BOARD, PC	52542	057520	057520	1

REPLACEABLE PARTS LIST

TITLE	A6A1, LOCK LOGIC PC ASSEMBLY #05791101 Rev A_1 6244A Only (Figure 7-20A)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	CR101	DIODE, Signal 50V	03508	1N4151	100385	1
	R101	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	101570	2
	R102	RESISTOR, CC 680 k 5%, 1/4W	01121	CB6845	101675	1
	R103	Same as R101				
	R104	RESISTOR, CC 33 k 5%, 1/4W	01121	CB3335	101576	2
	R105	Same as R104				
	U9	INTEGRATED CIRCUIT Differential Voltage Comparator	01295	SN72311P	103943	1
		CONNECTOR, Header 4-pin Dual	Berg	65781-008	117356	1
		BOARD, PC	52542	057911	057911	1

REPLACEABLE PARTS LIST

TITLE	OPTION 06, CHARGER PC ASSEMBLY #05772501 Rev D (Figure 7-22 & 7-23)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1 thru C3	CAPACITOR, Ceramic 1 μF 20%, 50V	56289	5CZ5U105X0050C5	100176	3
	CR1 thru CR4	DIODE, Rectifier 50V	81483	30S05	103252	5
	CR5	DIODE, Signal 50V	03508	1N4151	100385	2
	CR6	DIODE, Reference 6.2V	04713	1N823	720461	2
	CR7	Same as CR1				
	CR8	Same as CR5				
	CR9	Same as CR6				
	CR10	DIODE, Zener 15V	04713	1N965B	100385	1
	J1	CONNECTOR, Plug 5-position	27264	03-06-2055	101263	1
	Q1	TRANSISTOR, SINPN	04713	2N5190	101394	1
	Q2	TRANSISTOR, SINPN 40V	04713	2N3904	101377	1
	Q3	TRANSISTOR, SIPNP	04713	2N5193	101405	1
	Q4	TRANSISTOR, SIPNP 40V	04713	2N3906	101378	2
	Q5	Same as Q4				
	R1	RESISTOR, CC 4.7 Ω 5%, 1/4W	01121	CB47G5	10179601	4
	R2	Same as R1				
	R3	RESISTOR, CC 270 Ω 5%, 1/4W	01121	CB2715	10154201	2
	R4	RESISTOR, CC 680 Ω 5%, 1/4W	01121	CB6815	10166901	1
	R5	RESISTOR, CC 1 k 5%, 1/4W	01121	CB1025	10156901	4
	R6	Not Used				
	R7	RESISTOR, CC 1.5 k 5%, 1/4W	01121	CB1525	10157701	2
	R8	Not Used				
	R9	RESISTOR, MF 7.5 k 1%, 1/8W	91637	MFF 1/8 T1	102278	1
	R10	RESISTOR, CC 2.2 k 5%, 1/4W	01121	CB2225	10156201	1
	R11	RESISTOR, MF 10 k 1%, 1/8W	19701	MF5C-D-1002-F	102098	2
	R12	RESISTOR, Variable 2 k 20%, 1/2W	80294	3329H-1-202	101915	2

TITLE: OPTION 06, CHARGER PC ASSEMBLY #05772501 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R13	Same as R1				
	R14	Same as R1				
	R15	Same as R3				
	R16	Same as R5				
	R17	Same as R5				
	R18	Not Used				
	R19	Same as R7				
	R20	Not Used				
	R21	RESISTOR, MF 12.1 k 1%, 1/8W	81349	RN60D1212F	117774	1
	R22	RESISTOR, CC 1.8 k 5%, 1/4W	01121	CB1825	10160201	1
	R23	Same as R11				
	R24	Same as R12				
	R25	Same as R5				
	R26	RESISTOR, CC 100 k 5%, 1/4W	01121	CB1045	10155801	1
	R27	RESISTOR, WW 50 Ω 3%, 3W	15915	TS2C	630220	1
	TP1	TEST POINT, Black	74970	105-0853-001	100542	1
	TP2	TEST POINT, Black	74970	105-0856-001	100544	1
	TP3	TEST POINT, Blue	74970	105-0860-001	100547	1
	TP4	TEST POINT, Tab .025W			116952	1
	U1	INTEGRATED CIRCUIT, LIN MSC Differential Voltage Comparator	01295	SN72311P	103943	2
	U2	Same as U1				
		TERMINAL, Swage	88245	1000B	100482	6
		BOARD, PC	52542	057725	057725	1

REPLACEABLE PARTS LIST

TITLE	OPTION 08 TCXO OSCILLATOR #057666 Rev A					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		ADD				
	Y1	OSCILLATOR, TCXO 10 MHz	52542	100033	100033	1
		DELETE				
	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	2
		WASHER, Flat #6	86928	5710-23-10	100662	2
		WASHER, Split #6	96906	MS35338-136	100712	2

REPLACEABLE PARTS LIST

TITLE	OPTION 09, TCXO ASSEMBLY #057667 Rev A				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		DELETE				
	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	2
		WASHER, Flat #6	86928	5710-23-18	100662	2
		WASHER, Split-Lock #6	96906	MS35338-136	100712	2
		ADD				
	Y1	OSCILLATOR, TCXO 10 MHz	52542	102963	102963	1

REPLACEABLE PARTS LIST

TITLE		OPTION 10, HIGH STABILITY OSCILLATOR #057856 Rev B (Figure 7-24)				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		DELETE				
	A2	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
		ADD				
11	A3	OSCILLATOR, High Stability	52542	057817	057817	1
12	C10	CAPACITOR, El Can 1500 μF 50V	99392	23C50TS152	106468	1
13		HEATSINK, Vertical PC	98978	PSD1-2ND	117107	1
14	XU29	SOCKET, IC 3-pin	27264	10-18-2031	117324	1
15	U29	INTEGRATED CIRCUIT Voltage Regulator +15V	04713	MC7815CP	103039	1
16	C11	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	2
17	C12	Same as C11				
19		SCREW, PHMS 4-40 x 1/4	96906	MS51957-13	10062604	3
20		WASHER, Split #4	96906	MS35338-135	100711	3
21		WASHER, Nylon #4	86445	S331-H	100815	2
22		NUT, Hex 4-40	96906	MS35649-244	100707	1

REPLACEABLE PARTS LIST

TITLE	OPTIONS 11, 12 and 13 TOP COVER ASSEMBLY #067453 Rev C (Figure 7-26)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
4		BRACKET, Mounting	52542	067447	067447	1
5		COVER, Finish Top	52542	057845	057845	1
6	A3	OSCILLATOR, 10 MHz Option 11	52542	057827	057827	1
6	A3	OSCILLATOR, 10 MHz Option 12	52542	057828	057828	1
6	A3	OSCILLATOR, 10 MHz Option 13	52542	057829	057829	1
7	T2	TRANSFORMER	52542	067295	067295	1
8	CR1 thru CR4	DIODE, Rectifier	14099	SSIM	106555	4
9	U29	INTEGRATED CIRCUIT Voltage Regulator +15V	04713	MC7815CP	103039	1
10		CONNECTOR, Molex 5-pin	27264	03-06-2055	101263	1
11		PIN, Male (P/O 101263)	27264	02-06-2132	10282205	5
12		SCREW, PHMS 4-40 x 1	96906	MS51957-21	10062616	2
13		SCREW, PHMS 6-32 x 1/4	96906	MS51957-26	10063204	4
14		SCREW, FHMS 6-32 x 1/4	96906	MS24693-C24	10073104	5
16		WASHER, Flat #4	96906	MS15795-803	100703	2
17		WASHER, Split #4	96906	MS35338-135	100711	2
18		WASHER, Split #6	96906	MS35338-136	100712	5
20		NUT, Hex 4-40	96906	MS35649-244	100707	2
21		NUT, Hex 6-32	96906	NAS671C6	100638	1
22		TERMINAL, Strip	71785	52A	100664	2
23		RIVET, 1/8 x 1/8	12014	R-3472X1/8 NICL	100645	2
25		TIE, Cable	06383	SSTIM	100753	A/R
29	C11	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	2
	C12	Same as C11				

REPLACEABLE PARTS LIST

TITLE		OPTION 11 HIGH STABILITY OSCILLATOR #067871 Rev A				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		DELETE				
	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
		COVER, Top	52542	057260	057260	1
		ADD				
11		ASSEMBLY, Top Cover	52542	067453	067453	1
12	C10	CAPACITOR, El Can (P/O Logic Assy) 1500 μF 50V	99392	23C50TS152	106468	1
13		CONNECTOR, Molex 5-pin	27264	03-06-1055	101264	1
14		PIN, Male (P/O 101264)	27264	02-06-1132	10282204	5
23		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	1
24		WASHER, Flat #6	96906	MS15795-805	100704	1
25		WASHER, Split #6	96906	MS35338-136	100712	1
26		NUT, Hex 6-32	96906	MS35649-264	100706	1
28		TIE, Cable	06383	SSTIM	100753	A/R
29		CLAMP, Cable	98978	3/16	102931	1

REPLACEABLE PARTS LIST

TITLE	OPTION 12, HIGH STABILITY OSCILLATOR #067872 Rev A					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		DELETE				
	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
		COVER, Top	52542	057260	057260	1
		ADD				
11		ASSEMBLY, Top Cover	52542	067453	067453	1
12	C10	CAPACITOR, El Can (P/O Logic Assy) 1500 μF 50V	99392	23C50TS152	106468	1
13		CONNECTOR, Molex 5-pin	27264	03-06-1055	101264	1
14		PIN, Male (P/O 101264)	27264	02-06-1132	10282204	5
23		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	1
24		WASHER, Flat #6	96906	MS15795-805	100704	1
25		WASHER, Split #6	96906	MS35338-136	100712	1
26		NUT, Hex 6-32	96906	MS35649-264	100706	1
28		TIE, Cable	06383	SSTIM	100753	A/R
29		CLAMP, Cable	95987	3/16	102931	1

REPLACEABLE PARTS LIST

TITLE		OPTION 13, HIGH STABILITY OSCILLATOR #067465 Rev C_1 (Figure 7-25)				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		DELETE				
	A3	ASSEMBLY, 10 MHz Oscillator PC	52542	05708801	05708801	1
		COVER, Top	52542	057260	057260	1
		ADD				
11		ASSEMBLY, Top Cover	52542	067453	067453	1
12	C10	CAPACITOR, El Can (P/O Logic Assy) 1500 μF 50V	99392	23C50TS152	106468	1
13		CONNECTOR, Molex 5-pin	27264	03-06-1055	101264	1
14		PIN, Male (P/O 101264)	27264	02-06-1132	10282204	5
23		SCREW, PHMS 6-32 x 5/16	96906	MS51957-27	10063205	1
24		WASHER, Flat #6	96906	MS15795-805	100704	1
25		WASHER, Split #6	96906	MS35338-136	100712	1
26		NUT, Hex 6-32	96906	MS35649-264	100706	1
28		TIE, Cable	06383	SSTIM	100753	A/R
29		CLAMP, Cable	95987	3/16	102931	1

REPLACEABLE PARTS LIST

TITLE: OPTION 35, PARALLEL BCD OUTPUT #057776 Rev A_1 (Figure 7-28)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, BCD PC	52542	05770101	05770101	1
2	P1	ASSEMBLY, Cable 25 conductor	52542	057778	057778	1
3	P2	ASSEMBLY, Cable 50 conductor	52542	057777	057777	1
4		BUSHING, Snap 3/8	28520	SB-562-6	117281	1
5		BUSHING, Snap 1/2	28520	SB-687-8	117283	1
6		TIE, Cable	T & B	TY-24M	112488	2
7		BOX, BCD	52542	057713	057713	1
8		COVER, BCD	52542	057714	057714	1
9		SCREW, PHMS 6-32 x 5/8	96906	MS51957-31	10063210	4
10		WASHER, Split #6	96906	MS35338-136	100712	4

REPLACEABLE PARTS LIST

TITLE	OPTION 35, BCD PC ASSEMBLY #05770101 Rev A (Figure 7-30)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, Tant 1 μF 10%, 35V	56289	150D105X9035A2	100082	1
	R1 thru R5	RESISTOR, CC 100 k 5%, 1/8W	01121	BB1045	101976	5
	R6	RESISTOR, CC 10 k 5%, 1/8W	01121	BB1035	101697	3
	R7	Same as R6				
	R8	Same as R6				
	U1	INTEGRATED CIRCUIT, CMOS Hex Inverter Buffer	04713	MC14049BCP	103217	8
	U2	INTEGRATED CIRCUIT, CMOS Dual 4 Bit Latch	04713	MC14508BCP	117257	4
	U3	Same as U2				
	U4 thru U7	Same as U1				
	U8	Same as U2				
	U9	Same as U2				
	U10	Same as U1				
	U11	Same as U1				
	U12	INTEGRATED CIRCUIT, CMOS Quad 2-Input AND Gate	04713	MC14081BCP	116101	1
	U13	Same as U1				
		SPACER, Swage 6 x 1/4	71279	1247-11	100539	4
		BOARD, PC	52542	057701	057701	1
		ASSEMBLY, Cable 25 Conductor	52542	057778	057778	Ref
1	P1	CONNECTOR, 24-pin	02660	57-30240	101166	1
2		CABLE, 25 Conductor	70903	8459	117131	A/R
		ASSEMBLY, Cable 50 Conductor	52542	057777	057777	Ref
1	P2	CONNECTOR, 50-pin	02660	57-30500	101157	1
2		CABLE, 50 Conductor	70903	8459	100112	A/R

REPLACEABLE PARTS LIST

TITLE	OPTION 45, TONE MULTIPLIER ASSEMBLY #057665 Rev B				
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		ADD				
	A5	ASSEMBLY, Multiplier PC	52542	05757401	05757401	1
		SCREW, PHMS 6-32 x 3/4	96906	MS51957-32	10063212	2
		WASHER, Split #6	96906	MS35338-136	100712	2

REPLACEABLE PARTS LIST

TITLE	OPTION 45, A5 TONE MULTIPLIER PC ASSEMBLY =05757401 Rev B (Figure 7-33 & 7-34) Model's 6141A, 6242A and 6243A Only					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C1	CAPACITOR, DP Ceramic 56 pF 5%, 100V	96733	DB44BY560J	117625	2
	C2	Same as C1				
	C3	Factory Select				
	C4	CAPACITOR, DP Ceramic 330 pF 5%, 100V	96733	DB45BY331J	117636	1
	C5	CAPACITOR, Ceramic 1 μF 20%, 50V	56289	5CZU105X0050C5	100176	2
	C6	Same as C5				
	C7	CAPACITOR, Tant 4.7 μF 10%, 10V	56289	150D415X9010A2	100205	1
	J1	CONNECTOR	30146	929838-01-36	117179	1
	P1	CONNECTOR, 2 x 36	30146	929836-01-36	116937	1
	R1	RESISTOR, CC 10 k 5%, 1/4W	01121	CB1035	100570	2
	R2	Same as R1				
	R3	RESISTOR, CC 220 Ω 5%, 1/4W	01121	CB2215	101566	1
	R4	RESISTOR, CC 560 k 5%, 1/4W	01121	CB5645	101687	1
	R5	RESISTOR, CC 100 k 5%, 1/4W	01121	CB1045	101558	1
	R6	RESISTOR, Variable 1T Top Adj 5 k 10%, 1/2W	73138	72PR5K	103788	1
	R7	RESISTOR, Variable 1T Top Adj 2 M 10%, .5W	73138	72PR2MEG	116938	1
	R8	RESISTOR, CC 6.8 k 5%, 1/4W	01121	CB6825	101544	1
	R9	RESISTOR, CC 12 k 5%, 1/4W	01121	CB1245	101565	1
	U1	INTEGRATED CIRCUIT, CMOS Dual Monostable MVB	04713	MC14528CP	045289	1
	U2	INTEGRATED CIRCUIT, CMOS Phase Locked Loop	04713	MC14046CP	103939	1
	U3	INTEGRATED CIRCUIT, CMOS Dual BCD Up Counter	04713	MC14518CP	103339	1
	U4	INTEGRATED CIRCUIT, CMOS Quad 2-Input NAND Gate	04713	MC14011CP	103937	1
	U5	INTEGRATED CIRCUIT, CMOS Dual D Flip-Flop	04713	MC14013CP	103199	1

TITLE	OPTION 45, A5 TONE MULTIPLIER PC ASSEMBLY #05757401 (Cont'd)					
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U6	INTEGRATED CIRCUIT, CMOS Hex Inverter Buffer	04713	MC14049CP	103217	1
		SPACER, Swage 6 x 7/16 L	06540	95368-A-140-17	116936	2
		BOARD, PC	52542	057574	057574	1

CHAPTER 7

DRAWINGS

7.1 INTRODUCTION

This chapter contains the final assembly and schematic drawings for the Model 624XA Frequency Counters. The parts list contained in Chapter 6 relates to the reference designation callouts on the diagrams. Table 7-1 provides a list of drawings with title, drawing number and manual page number.

TABLE 7-1 LIST OF DRAWINGS

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7-9	A1, 100 MHz Amp Schematic	7-05723801	7-9
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